Municipal Engineering; Paper No. 1.*

BOSTON, MASSACHUSETTS.

(*Concluded from page 194.*)

City Architect.

This official, not generally found in large cities, is appointed annually by the Mayor; must be a citizen of Boston and devote his whole time to the service of the city.

His duties are to prepare all plans, specifications and estimates for such city work as would be required of an architect. He must also visit and examine all public buildings in process of erection from his plans to see that these are conformed with; and he must attend the opening of bids for building structures from his designs or specifications and in conjunction with the Superintendent of Buildings pass upon the fitness of the bidder, as to whether he is competent to perform the contract in a workmanlike manner or is financially able to faithfully execute such a contract. The City Architect is allowed the assistance of two clerks, a foreman and nine draughtsmen.

Superintendent of Public Buildings.

This officer is appointed annually by the Mayor. His duties are defined as follows:—Plans, specifications and estimates for any building prepared by the City Architect, and approved by the departments for which they are intended, are transmitted to the Superintendent of Public Buildings, who will then issue proposals for contracts for the various portions of the work; making, where feasible a separate contract for each class of work, estimated to cost more than $2,000. He then inspects the work in progress, examines and approves all bills, and transmits them to the City Auditor for settlement.

This superintendent has the care and custody of schoolhouses and other buildings belonging to, or hired by the city; he provides necessary furniture and supplies, except printing, and superintends repairs and alterations; he has also charge of the city property in the armories. He can, however, make no expenditure exceeding $1,000 without the express vote of the City Council.

The Inspector of Buildings.

An act of the Massachusetts Legislature (approved June 19, 1885) relates especially to the inspection and construction of buildings in the city of Boston. The law provides for a department to be called the Department for the Inspection of Buildings.

The chief officer of this department is called the Inspector of Buildings, and he is appointed by the Mayor of Boston to serve three years, unless sooner removed by the Mayor for cause. The inspector and his sixteen assistant inspectors must be "able and experienced architects, builders or mechanics," and must devote themselves solely to the service of the city. They have a legal right to enter any building or premises in Boston.

The duties of this officer and the regulations relating to buildings in Boston, are very carefully defined in the 148 sections of the act referred to, but we can only afford space for some of the more important of these requirements.

Within certain limits defined on a plan made by the City Surveyor and dated June 28, 1881, all buildings hereafter erected must conform strictly to the requirements of the law of 1885; outside of these limits wooden buildings may be built under restrictions to be again referred to.

No work of any kind, except necessary repairs, can be done upon a building without a permit from the inspector. And before a permit is granted for new buildings, he must carefully inspect the plans and specifications, and see that they conform in all respects with the requirement of the laws. Within the prescribed limits every building erected must be of brick, stone, iron or other incombustible material; the only wooden buildings allowed in these limits are: sheds not more than 27 feet high on wharves; sheds for market purposes, or to facilitate the building of authorized buildings; elevators of any height for the storage of coal or grain, provided all external parts are covered with incombustible material.

The legal factor of safety for all beams, girders or other members subjected to cross strain, is as one to three; for posts or other vertical supports, one to six, and the same for all members subjected to a tensile strain. The safe load for floors per superficial foot, exclusive of material, is fixed as follows:—For dwellings, tenement or lodging houses, 100 pounds; for buildings for light mechanical purpose and for public buildings, 150 pounds; for store houses, warehouses, machine shops, armories, drill-rooms and riding-schools, not less than 250 pounds.

Outside the defined limits, wooden buildings may be erected for dwellings, provided that they do not exceed 45 feet in height and are not less than 18 inches from the limits of the lot upon which they stand; if a wooden building is already upon the line of the adjoining lot, a space of 3 feet must be left between it and the new building. Numerous other provisions follow in this connection.

The power of the Inspector of Buildings extends to many other classes of work besides the building proper, permits must be obtained from him for additions or alterations to existing buildings; for placing steam boilers, ovens and ranges and all heating apparatus; for plumbing in all its detail and for permission to occupy the street for building purposes. The application for a permit for building must state very fully all the details of the proposed structure, its location, owner, architecture, etc.; and the final report of the assistant inspector upon a completed building is practically a specification with sufficient data in it to rebuild the building in all respects save its ornamental detail. The office records are very complete, and include ground plans of all structures authorized. All plumbing and fixtures must be approved by the inspectors and the office complaint book shows the minute detail of this inspection.

The Superintendent of Lamps.

This officer is appointed annually by the Mayor. His duties are to set up street lamps in such places as the Board of Aldermen may direct, and to care for them and see that they are properly lighted each night. He is allowed the assistance of three clerks, five repairers and 112 lamplighters.

On January 1, 1885, the number of public lamps of all kinds in Boston was as follows:—

Gas lamps	9,781
Large gas lamps	36
Oil lamps	2,591
Electric lamps	401
Total	12,809

The department expenses of all kinds for the year 1884-85 were $481,001.98.

Gas Lamps.—The prices paid for gas in the public lamps to the several gas companies in 1884-85 were as follows:—Boston, per 1000 cubic feet, $1,30; Roxbury, $1,65; Charlestown, $1,75; South and East Boston, $1,85; and Dorchester, West Roxbury, Brighton and Chelsea, $2. For these sums the contracting parties agree to furnish all the gas required for public lamps along the mains of the company, and that the hours of burning for each lamp shall not be less than 3,828 per annum. The companies put down and maintain all new pipe required; and the service pipe must be not less than 1-inch diameter with a regular fall towards the street mains. They must also use the Automatic Glycerine Burner, adopted by the city in 1879, which is said to give good satisfaction and to measure accurately the quantity of gas, of a certain specific gravity, which will pass per hour. The quantity consumed per hour is required to be not less than 4 cubic feet by each burner.

The city takes care of the lamps and burners and all pipe above ground, and pays all "actual, reasonable expenses" for labor and material expended in putting down or repairing the service pipes running to the mains. The lanterns used for the public lamps, are made of copper, tinned over on all sides.

The men who clean and light the lamps are paid at the rate of 1¾ cents per lamp per night, and each man has an average of ninety-six lamps to attend to; in the outlying districts, these lamplighters receive $1.70 per day. The lamps are lighted by the patent Bartlett Torch, the city having purchased the right to manufacture and use it in Boston. Lamps are lit according to a regular time schedule; the earliest hour for lighting being 4:15 P. M. in November and the latest 7:30 P. M. in July; they begin to extinguish the lamps at 3:0 A. M. in May and at 6:0 A. M. in January, these are the extremes. Each man is allowed one hour to go over his district.

Oil Lamps.—In these lamps petroleum (115 fire test) is used, and the oil is bought at the lowest market rates, the price fluctuating between 8¼ and 6 cents per gallon in 1884-85. The "Fireside" B burner is used, and the total cost of maintenance of each lamp for the year was $13.73, this includes lighting, care, oil-fonts, chimneys and wick. The lamplighters are paid 3¼ cents per lamp per night for lighting and cleaning.

Electric Light.—The electric light was introduced into Boston for street lighting purposes on February 15, 1882. The plant now in use includes 218 Brush lights; 141 N. E. Weston; twenty-six Merchants and sixteen Union, naming them by the several companies controlling them. The city provides the tall cast-iron posts used, and paid a royalty of $5.00 per post to George H. Allen for 159 of them in the year 1884-85, and the companies the lamps and light. The contract with the Brush Company specifies that the lights furnished must not be less than 2,000 candle power, French standard measurement; that they must be put at such points as the city councils may direct and that they must burn every night. The price paid by the city is sixty-five cents per lamp per night.

The last annual report of the Superintendent of Lamps figures the relative difference in the cost of burning gas, oil and electrics as follows:

	1883	1884.
Gas	$271,777.89	$255,463.30
Oil	6,479.36	5,565.93
Electric	58,855.18	90,785.80
Totals	$337,112.43	$351,815.03

Contracting.

The city ordinances governing all boards and heads of departments in letting public work may be condensed as follows:

Any work involving an expenditure of less than $1,000 may be awarded by the head of a department or board without advertisement.

If the estimated amount exceeds $1,000, the approval of the Mayor must first be obtained, and reasonable notice given by advertisement in one or more daily papers of the city, and elsewhere if necessary.

Suitable and sufficient plans, specifications and schedules of materials or supplies must be prepared and exhibited to those proposing

to bid. All written contracts must be executed in triplicate and one of these copies deposited with the city auditor; every contract exceeding $1,000 must be accompanied by a suitable bond for its performance, or by the deposit of money or security to the amount of the bond demanded.

All proposals must be sealed and placed in a sealed box in the department calling for the bid and of this box the mayor shall hold the only key. At the time designated in the advertisement and in the presence of the mayor or his designated deputy, all proposals must be publicly opened. The present ordinances also specify that "the contract shall be then and there awarded to the lowest bidder complying with the terms; *provided, however*, if any such proposal shall be offered by persons, who, in the judgment of the officer or board issuing the advertisement, shall be incompetent to perform their contract in a workmanlike manner, or irresponsible in respect to their means of faithfully executing the same, such proposal may be rejected, notwithstanding the same be at a lower rate than other proposals offered for the same work, and the next higher bidder shall be substituted. And *provided, also*, in all cases, that the officer or board may reject all bids, with the consent of the mayor, and issue new advertisements."

The above ordinance is faulty in the clause requiring *immediate* award of contract, as the tabulation of numerous and complicated bids would be absolutely necessary before any intelligent opinion could be formed; and such collation would often consume more time than could be given to one sitting of an awarding board. Judging from conversation with the present heads of some of the Boston departments, this ordinance will be remodeled at an early date by the city councils.

All proposals must be duly recorded in the records of the department calling for them, and after a contract has been awarded and accepted such records must be open to public inspection.

The contract cannot be altered after it is signed, in any particular, without the consent of the contractor, department or board contracting, and the mayor being endorsed upon it. And no proposal will be received from any party who has broken a contract with the city during the preceding three years.

No officer or board can make a contract in behalf of the city, the execution of which shall necessarily extend beyond one year from date, without special permission to do so from the city council or the State.

In contracts involving the employment of mechanics or laborers by the contractor, a provision shall be inserted to the effect that the board, etc., may, if it deem fit, retain from any amount due the contractor a sufficient sum to cover any unpaid claims of mechanics or laborers for work or labor performed under such contract; but notice in writing of such claims must be signed by the the claimants and previously filed with the city clerk. The assignment of wages of employés is to be prevented if possible by the heads of departments.

As mentioned under the head of "Water Board," that board has certain contracting powers exceeding those of other departments.

Superintendent of the Common and Public Grounds.

This officer is appointed annually by the mayor; he must be a citizen of Boston, and is allowed a yearly salary of $3,000.

This superintendent has the care and maintenance of the Common, Public Garden, and all the public squares and enclosures in the city and the trees in the streets of the city.

All public lands other than the above and land connected with the public institutions or purchased and held for specific purposes, are in the charge of the Street Commissioners, who may sell or lease the same; provided that all deeds, leases and contracts are signed by the mayor and countersigned by the Chairman of the Board of Street Commissioners.

The total payment made in 1884 for the care and improvement of the Common, Public Garden and public squares, including the trees in the streets, was, as per City Auditor's report, $66,710.11.

The total area of the public grounds and city squares within the corporate limits of the present Boston, is 231 acres. And the cost of maintenance and improvement in 1884 amounted to $288.78 per acre, including in this account the care of trees on the city streets.

THE END.

Country Tramways.*

Written for ENGINEERING NEWS.

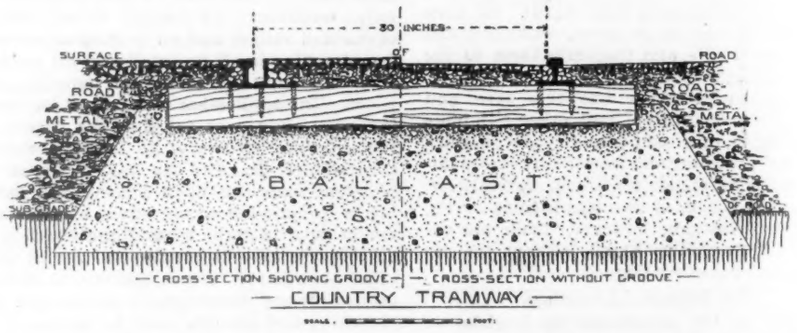
BY EDWARD E. R. TRATMAN.

Tramways for the purpose of affording traveling accommodations in suburban and thinly populated districts, though adopted to a considerable extent in England and on the European continent, have not received much attention in this country, where, however, there is without doubt a wide field for their operation; and the writer, while recognizing the advantages of ordinary railroads for opening up and accommodating the less populous parts of the country, is of opinion that in many places where a railroad is out of the question, a tramway will secure enough traffic to make a return to the promoters of the enterprise, even though in future years as the neighborhood becomes more and more settled up, a railroad should be constructed to tap practically the same route and district.

In some cases where a system of rapid transit is required between villages and country towns not conveniently situated to a railroad, or between such towns and a main line of railroad, or in other instances; local circumstances, the cost of building and working, or the comparative unimportance of the connection may render a railroad of ordinary construction undesirable; the question then lies between a narrow gauge light railroad and a tramway, also of narrow gauge; and as the circumstances in each case will vary very considerably, we shall not discuss the various pros and cons of each class of line, but shall assume for the purpose of this article that after due consideration a tramway has been decided upon, to be laid along an existing highway and to accommodate both passenger and freight traffic.

Where the road is sufficiently wide to allow of the widest vehicles on the road passing easily between the cars and the fence on either side, the line may be laid in the middle of the road, but in most cases it will be better to build it at the side, thus interfering as little as possible with the ordinary traffic. In Europe, where the roads have often a strip of waste ground on one or both sides between the carriageway and the fence, this waste is frequently used for the tramway, and this is probably the most advantageous construction that could be devised, for not only are the joints and fastenings easily accessible without breaking up the roadway, but the rails are kept clean and are not covered with mud and dust as they must almost necessarily be to some extent when placed in the road.

One of the first considerations before the line is located or the track designed, is that of the motive power, and for a road of this description steam traction will without doubt be more economical than animal traction. Taking this for granted, we next have to consider the relative merits for our purpose of an ordinary street-rail and a railroad T rail with a guard to form a groove for the wheel flanges, should a groove be required. As roads in this country have rarely such ground as above described available for the track, it is necessary to adopt the best method of construction that suggests itself for durability, stability, easy traction, and facility for repairs, while interfering as little as possible with the surface of the road. The T rail is the best for the purpose, and will prove the most economical, the street-rail (whether center or side bearing) not being well adapted for steam traction or for freight traffic, besides being weak in its attachments; and while a heavier rail is required for the same service it has to be laid on a continuous stringer; the less timber that is employed the better, and as the T rail dispenses with this stringer, is more secure, and forms a more firm and durable track, this form should be adopted, being spiked to crossties in the ordinary manner.



In view of the limited amount of traffic which will probably come upon the line, a narrow gauge has been adopted as a prime factor in the project, and in order to carry out the economy, the gauge should be as narrow as practicable. Railroads of 24-inch gauge have been operated in this and other countries with success, but as a general rule a gauge of 30 inches should be adopted, though a narrower gauge may be employed on narrow roads or under special circumstances. The 30-inch gauge will, however, be amply sufficient in all ordinary cases. The speed should be limited to a maximum of fifteen miles per hour.

Unless the profile of the road is very irregular and includes heavy grades, the amount of cuts, fills and works will be almost nil, while with regard to curves these may be made, where necessary, of a very small radius; for ordinary purposes we may assume a maximum grade of 1 in 20, and a minimum curve of 100 feet radius. For lines of any considerable length on a winding road some sharp and

*The writer has adopted throughout this article the more appropriate English term "tramway" in preference to "street railroad," because lines of the class here considered cannot properly be denoted by the latter term.

reverse curves may be eased off by arranging with landowners for the line to cut across the projecting corners of fields, etc., a method which has been adopted successfully on the steam tramway from The Hague to Scheveningen, belonging to the Dutch Rhenish Railway Company.

The rails should be of steel, about twenty-five pounds per yard and 25 feet in length; they will be spiked with 3½-inch spikes to cross-ties spaced about 2 feet center to center, and 18 inches center to center at the joints; these ties will be 4 feet × 6 inches ×4 inches. The rail joints will be fished and bolted in the usual way, straight fish-bars being amply sufficient for light rails and light traffic. In general the highway authorities will allow the head of the rail to project above the surface of the road, and as the rails are small and the gauge narrow, there will be but little inconvenience to ordinary traffic. The cross-section of the track may have the road surface brought up to the under side of the rail head, both outside and inside, or the road surface outside the track may be made level with the top of the rail. The former will be the most convenient and economical for the tramway traffic and will be little, if any, more annoying to road traffic than the latter. Where, however, a groove is required, an angle-iron of the same height as the rail may be spiked to the ties on the inside of the rail, leaving a space for the grooves about one inch in width: this iron should break joint with the rails. The ballast will be about 6 feet wide and 15 inches thick; it may be composed of any suitable material that is handy, either broken stone or brick, coarse gravel, slag, etc. The space between and outside the rails will be filled in with the same material as the road paving, usually macadam, carefully laid at the sides of the rail with large stones firmly packed down to prevent ruts forming alongside the head.

The locomotives should weigh about nine tons in full working order, which will enable them to be of sufficient size and power to haul any traffic that is likely to be conveyed over the line. They should have a low center of gravity, and as long wheel-base as is consistent with the location of the track; and should be of strong and substantial construction so as to stand the rough handling they are likely to get from the employés of the road. They should have a leading pony-truck to lengthen the wheel-base, and a four-wheeled engine should never be employed when it can be avoided, as the pitching motion is destructive to the track and unpleasant to the driver. The working parts should be boxed in with a light framing, hinged so that it can be raised for convenience of oiling, inspection and repairs; some form of pilot should be fitted to the leading end to protect as far as possible persons who may be struck by the engine. Whether it is to be entirely enclosed depends largely on the requirements of the local authorities. Where the passenger traffic is small it may be found economical to employ a steam car, thereby reducing the dead load, but this is not likely to be required in many places.

The rolling-stock will have a uniform width of 6 feet 6 inches and a length of 25 to 30 feet; in cases where there is a large passenger traffic the passenger cars may be as long as 40 feet. Both freight and passenger cars will be adapted to the requirements of each line. They will be carried on trucks with wheels 20 to 24 inches diameter and will be very similar in construction to ordinary standard-gauge cars; the passenger cars will be of two types, open cars with transverse seats and a wide footboard for summer use, and ordinary closed cars. They should be fitted with sufficient lamps, hand-rails, etc., neatly upholstered—preferably with cane covered cushions—and decorated, and clearly lettered; they should be constructed with a view to economy of cost and maintenance, and with due regard to the convenience of passengers. On narrow roads the cars may have a middle row of seats back to back. They should have a simple and efficient central coupling and spring-buffer combined, and should be fitted with continuous brakes, or at any rate a brake on each car. No detailed description, however, of the rolling-stock can be given as it will necessarily vary to conform to the requirements of each line; but in general it will consist of passenger, composite baggage and passenger, box and flat cars. There should always be a sufficient number of locomotives and cars to allow of repairs without running them too long, or interfering with the train service, and to accommodate extra traffic on an emergency. One of the reserve engines may be employed to drive the machinery in the repair shop, thus saving the expense of an extra boiler for this purpose.

The speed will vary from ten to fifteen miles per hour, and with the small amount of traffic likely to occur, the line may, in most cases, be worked satisfactorily on the "shuttle" system, thus considerably reducing the chances of accident. Where the traffic is continuous, however, or the line is of sufficient length to warrant it, a turnout may be laid to enable trains to pass; a rule of the road being adopted to ensure safe and regular running, aided, if considered necessary, by simple automatic signals. The switches at these turnouts should be fitted with springs to hold them in position for the normal direction of the trains. Sidings may be laid, where desired, into the yards of factories, etc., to enable freight to be loaded and unloaded direct on the premises.

The buildings should be of simple and economical construction, but should be designed with a view to convenience and the accommodation of passengers and freight. They will comprise in almost every case a depot at each terminus of the line for freight and passengers, an engine and car shed, and small repair shop; while at important cross-roads, etc., where there is much traffic, a small waiting room may be a public convenience. They should preferably be of brick in consequence of the liability to fire, but may be of concrete or corrugated iron; wood should never be adopted for the engine shed. The passenger accommodation should include waiting-rooms and conveniences for both sexes; and a clerk should be in attendance who may also act as freight agent. Facilities for handling freight should be provided, including cranes and other appliances, and a platform on a level with the car floors, having ramps to the freight yard as well as places for unloading carts. As a general case tickets will not be required, fares being collected by the conductor; where tickets are used, however, they should be for sale not only at the depots but also at leading hotels, stores and other places.

The line has here been considered with a substructure of wood, as that would be the style of construction most generally adopted, but for lines of importance a metal track would probably be most economical, taking all things into consideration. Light iron or steel ties of approved design, laid in a concreted ballast and having a simple and efficient fastening for the rail would be the best form of track, and would require less care and expense for maintenance and repair than the ordinary style of track.

The charge of track, locomotives, rolling stock and operation should not be left to inefficient parties, but a resident manager or superintendent should be appointed who can intelligently superintend the working and maintenance, but this is another matter which should receive special attention in each instance.

With regard to the clogging of the groove by snow or mud, a vertical blade fixed to the engine frame and entering the groove would cut up all hard and impacted matter, which could be removed by an inclined scoop, both being fixed before the wheels: where there is no groove an ordinary flanging scraper will suffice. With a water or steam jet from the locomotive for use in bad weather or with dirty rails this clogging would not be found a serious inconvenience.

In conclusion, while urging that more attention be given to this class of road for increasing traffic facilities, I put as a leading feature in their adoption the careful consideration of local circumstances and requirements, so as to render the line as convenient and economical as possible, and with a view to the greatest possible reasonable returns from the enterprise.

ESTIMATE OF COST PER MILE.

Rails,		
Steel, 25 lbs. per yd. 39.3 tons	@ $35	$1,375.50
Splice plates,		
844, 16 ins. long, 5¼ lbs. per pair	@ 2 cts.	44.31
Splice bolts and nuts,		
1,688, 2¼ ins. × ½-in. bolts, 4½ oz.	@ 3 "	14.25
Ties,		
2,746, 4 ft. × 4 ins. × 6 ins.	@ 15 "	411.90
Spikes,		
5,492, 3½ ins. × ⅞ ins.	@ 2.4 "	33.60
Total		$1,879.56
WITH GROOVE.		
Track as above		$1,879.56
Angle-iron, 15 lbs. per yard	@ 2 cts.	1,056.00
Spikes, 5,492, 3½ ins. × ⅞ ins.	@ 2.4 "	33.60
Total		$2,969.16

The Goldschmid Aneroid.*

BY GEO. J. SPECHT, MEM. TECH. SOC.

It need hardly be stated that all aneroid barometers make use of the elasticity of a hermetically sealed box, or other closed compartment in which a partial vacuum has been established, to measure changes in atmosphere pressure. The movements of the box, always small, are magnified by means of a somewhat complex system of delicate levers in the ordinary aneroid forms, of which that of Naudet's may be taken as a type. The extreme delicacy of the intermediate transmission has always proved the objectionable feature and the main source of inaccuracy, and it was with the object of totally suppressing this transmission that Goldschmid successively designed the series of instruments which bear his name. The movements of the vacuum box were observed either by a micrometer screw or, as in the Goldschmid-Weilenmann's aneroid, several boxes are mounted, one upon another, the upper one of the series carrying an index, whose motion is observed by a minute telescope provided with cross-hairs, and mounted upon a micrometer screw.

The original instrument with a single box proved deficient in delicacy, and the compound-box aneroid disappointed the expectations of its designers in not possessing the requisite qualities of standing ordinary rough handling in shipment or field use. While giving admirable results when left stationary or carefully carried upon an observer's person, curiously enough this compound-box aneroid (No. 3), showed that sudden jars produced very considerable changes in the instrument—not abrupt changes only, but changes such that often weeks and months were required before the boxes again assumed a state of equilibrium. This deficiency was all the more surprising on account of the construction having

*From the Transactions of the Technical Society of the Pacific Coast.

been so simple, and all intermediate transmission having been eliminated, that special freedom from liability to disarrangement had been confidently anticipated.

Since Goldschmid's death his successor, Hottinger, of Zurich, has continued his investigations, and after many modifications and changes, has produced the type of instruments shown in Figs. 1, 2 and 3, known as the Goldschmid Aneroid No 1. The vacuum, *b b* (Figs. 1 and 2), is kept in tension by the steel spring, *f f*; this transfers the movement of the box-center to the lever, *h h*, turning on the fulcrum *a*. To the top of this lever, *h h* is attached a hair-spring, *e e*. The movements of the box are measured by means of a micrometer screw, *m*, whose contact with the hair-spring *e e*, must be ascertained with greater accuracy than is possible by the mere sense of touch, and and is accordingly indicated by the coincidence of two black lines on the heads of the lever, *h h*, and the hair-spring, *e e*, observed by means of a magnifying glass, *L*. The scale, *S S* (Fig. 3), gives the full revolution of the micrometer screw. The first instruments of this class were provided with a scale on which the readings increased with the altitude, the value of the scale-unit being arbitrary. The scale of the more recent instruments is divided to correspond with the mercurial barometer. Each revolution of the micrometer screw corresponds to 10 mm. of the mercury column, and the head of the micrometer screw is decimally graduated, admitting of accurate reading to the one-hundredth part of a millimeter.

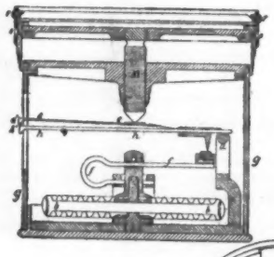


Fig. 1.

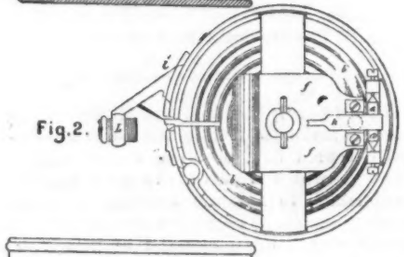


Fig. 2.

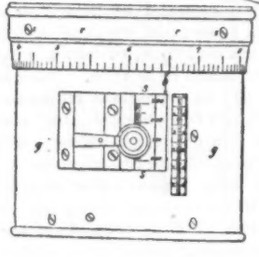


Fig. 3.

The usual size of this instrument is 3½ inches diameter and 2½ inches high. Fig. 1 is a vertical section; Fig. 2, a top view, the cover being removed; Fig. 3, a side view; *g g* is the outer shell; *r r* the revolving and graduated head; *h'* the end of the main lever, and *è* that of the hair-spring lever, each provided with an index-line; *S S* the scale by which the number of full revolutions of the micrometer screw *M*, are measured.

New aneroids give elevation at the ordinary atmosphere pressure (25 to 30 inches), correctly within one half of one per cent., the difference of elevation not being more than 750 to 1,000 feet. For the determination of greater differences of elevation old aneroids should be used, in which the box has obtained its equilibrium. Indeed it may be said that the instruments improve with age.

The influence of temperature upon 44 of these aneroids tested for a period of six months, at temperatures of 10° to 30° C. (50° to 86° Fahr.) was only 0.4 mm. per 1° C.

Each instrument is provided with a table of reduction, giving the value of its unit at different atmospheric pressures in millimeters, or inches of the mercurial barometer, and its value in inches or feet, and the correction for temperature. Each is rated individually and tested daily for four months at the factory before being sent out. No. 2 differs slightly from No. 1 in construction; is considerably smaller, and less sensitive, and is better adapted for tourists than for engineers. Its probable error is nearly double that of No. 1.

In the aneroid No 3, (Weilenmann's system), the small telescope already referred to is mounted upon a micrometer screw, which measures its movement. The cross-hairs of the telescope being brought into coincidence with the index on the upper of the combined series of boxes, the scale of the micrometer indicates directly the motion of the boxes in terms corresponding to the movements of the mercurial barometer.

The boxes are entirely independent of the micrometer screw, so that no changes in the instrument can occur by reason of wear on the point of the micrometer, or any other part. Its accuracy is so great that it can fully replace the mercury barometer at atmospheric pressure below 24 inches, and it is much more portable. Its size is 6 inches high by 3 inches diameter.

Self-registering Aneroid or Barograph.

The purpose of this instrument is to register automatically the readings of the aneroid, which consists of a number of boxes like the one just described, the movements being transferred by a lever to a paper on a drum revolved by clock work. Every hour a point is marked upon this paper, giving the reading of the aneroid. After forty-eight hours a paper three inches long is unwrapped, containing forty-eight equidistant points 1½ mm. apart. The dimensions of this instrument are such that the maximum motion of the pointer is 2 inches, corresponding to the same movement of the mercurial baromoter. Two-tenths of a millimeter can be read with certainty.

Actual observations made with a Goldschmid Aneroid, No. 1.

The elevations given below were measured along the Gotthard stage road (Switzerland):

Station.	True elevations.	Elevations determined by Aneroid.	Difference between both.	Station.	True Elevations.	Elevations determined by Aneroid.	Difference between both.
	Metres	Metres	Metres		Metres	Metres	Metres
Office	1178.2	.....	.....	8	1138.7	1139.0	—0.3
Cmty	1166.2	1166.2	.0	259	1136.2	1135.9	+0.3
1	1164.9	1165.6	—0.7	9	1130.3	1130.2	+0.1
2	1161.8	1163.0	—1.2	10	1130.3	1130.2	+0.1
3	1156.1	1158.0	—1.9	11	1126.2	1127.0	—0.8
4	1151.5	1151.6	—0.1	12	1122.2	1122.6	—0.4
5	1148.8	1148.5	+0.3	13	1120.9	1120.7	+0.2
6	1146.2	1145.4	+0.8	26	1120.9	.....	.....
7	1142.4	1141.6	+0.8	....	.....	.....	.....

Probable error, ascertained by the method of least squares: ±0.57.

Eighty-nine similar observations gave a probable error (difference of elevations being 100 meters) 0.62 metres.

104 observations with greater differences of elevations, made in the neighborhood of Zurich, gave as probable error: 0.68 metres.

In these observations the value of one aneroid-unit was ascertained by dividing the difference of the aneroid readings on both end-points by the true difference of the correct elevations. In the observations given below, the unit was determined by comparison with a mercury barometer:

Station.	Difference of elevations ascertained. By actual level.	Difference of elevations ascertained. By aneroid.	Difference between both.	Station.	Difference of elevations ascertained. By actual level.	Difference of elevations ascertained. By aneroid.	Difference between both.
	Metres.		Metres		Metres.		Metres
1	...	....	.....	11	31.3	31.0	+0.3
2	14.1	14.2	—0.1	12	35.3	35.5	—0.2
3	21.1	20.8	+0.3	13	30.4	30.2	+0.2
4	25.0	24.4	+0.6	14	41.3	41.2	+0.1
5	19.8	18.6	+1.2	15	50.5	50.6	—0.1
6	14.7	13.9	+0.8	16	60.5	60.9	—0.4
7	13.6	13.3	+0.3	17	78.5	77.8	+0.7
8	13.8	13.6	+0.2	18	102.3	101.5	+0.8
9	20.2	21.6	—1.4	19	118.1	116.6	+1.5
10	27.0	27.3	—0.3	..	....	....	..

Probable error: 0.47 metre.

The probable error of the Naudet aneroid, ascertained by different observers, varies as follows: ±0.94, ±1.10, ±1.09, ±1.80. Comparing this with the above results, it is evident that the Goldschmid aneroid, No. 1, gives better results than the Naudet aneroid.

The following two tables give the differences between the true elevations and those ascertained by aneroid in six different trials along the Gotthard stage road, the differences of elevation being greater than in the measurements given above.

GOESCHENER—ANDERMATT.

Period of observation, 3 hours.

Station.	Elevation. Metres	Differ'nces obtained with aneroid					
		No. I. Metres.		No. II. Metres.		No. III. Metres.	
Office.	1128.5						
6	1137.1	—2.0	—3.5	—2.6	.0	—2.7	—0.7
6a	1185.5	—0.8	—5.0	—3.2	—2.2	—1.0	—4.1
6b	1206.8	—3.1	+0.6	+1.3	+3.5	+2.6	—0.9
4	1235.3	—0.6	—1.0	+0.4	+6.0	+2.1	+1.3
3	1339.2	+0.9	—0.3	+0.7	.0	—0.2	+2.1
2	1402.5	+1.9	—2.2	+2.7	+0.4	+5.1	+2.0
0	1445.4	....	....	....	....	....	....
Probable error, Average, ±1.73			±1.61		±1.82		±1.75

AIROLO—ST. GOTTHARD.

Period of observation, 6 hours.

Office.	1177.6	I.			II.	
24	1357.1	+ 7.5	+ 0.3	— 0.8	— 3.2	+ 2.8
23	1429.9	+ 5.1	+ 1.6	— 3.4	— 5.8	+ 5.1
22	1461.2	+ 4.1	+ 0.1	— 0.8	— 1.9	— 3.1
21	1536.9	+ 3.6	+ 3.0	— 1.3	+ 2.4	— 3.1
18	1696.6	+ 6.9	+ 0.2	+ 0.5	— 3.9	— 2.9
17	1766.2	— 6.4	+ 5.6	+ 0.4	— 3.5	— 8.5
16	1829.0	+ 6.8	— 1.1	— 4.1	+ 1.2	— 3.6
15	1920.1	+ 4.9	— 6.1	— 6.5	— 5.3	— 0.8
14	1968.4	— 0.4	— 3.5	— 2.5	— 5.8	+ 2.9
13	2026.8	+ 0.7	— 6.7	+ 0.2	— 0.1	+ 1.9
12	2043.4	+ 2.0	— 6.8	— 4.8	— 8.2	0.
Hospice, 2100.0 Probable error, Average, ? 2.87			±2.92			±2.83

NEW EYE-BAR.—C. L. Strobel, of Pittsburgh Pa., has patented a process of manufacturing eye-bars having enlarged ends and a smaller shank or body between such ends. Heretofore the ends of the bar were heated and worked while the body was cold, which would produce a weakening of the neck, especially in steel. The entire bar had therefore to be restored to its normal condition by annealing. To overcome these difficulties the inventor forges on a billet or slab enlargements of approximately the finished shape of the head, and then reheats the blank so formed and rolls it to the required length and form without subsequent reheating. Thus the metal of the bar is brought to its final shape while, the entire bar is in a uniformly heated condition, and consequently the formation of any injurious strain is avoided.

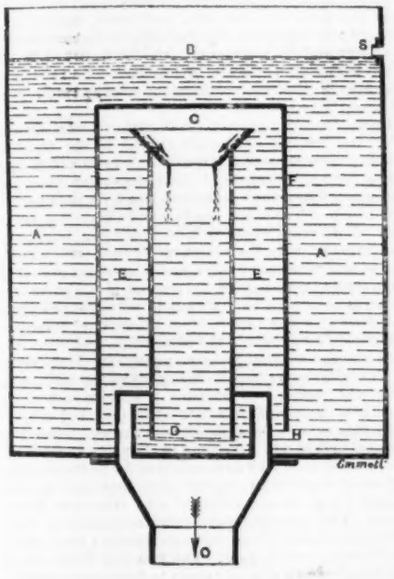
Improved Flush Tank.

The annexed illustration represents in section a newly introduced flushing tank, made by Messrs. Morrison, Ingram, and Co., of Cornbrook, Manchester, the object of which is to provide a sudden and copious flush of water at intervals of time, which can be varied by regulation of the cistern supply cock. *A* is the tank, which may be of any size required, and in practice varies from two to 100 gallons capacity. *O* is the outlet pipe connected by a water sealed trap *D*, with a pipe *C*, this last being in free communication with the cistern *A* by the annular passage *E*, formed by placing a cap *F* over the tube *C*.

Assuming the apparatus to be in working order, the following is the cycle of operations:

As the tank gradually fills from the supply pipe *S*, it rises also within the casing *E*, and finally overflows at *C* into the trap *D*, so sealing any further escape.

The water continuing to rise, the air which is imprisoned between the point *C* at the top of the inner tube and the seal *D* is compressed until when the water level in the tank rises to the level *B*, the pressure of the air is sufficient



to force the seal *D*, and the imprisoned air then escapes down the pipe *O*. This being the case, the level of the water in the annular *E* rises at once or tends to do so, to the level in the tank or to *B*, and of course overflows at *C* under the head of pressure *B* passing down *C*, and through the trap *D* into the down pipe *O*, which is preferably of considerable length, a most efficient syphon is formed, and the whole contents of the tank quickly run out down to the level of the lip *H*, when the supply slowly running in again fills the tank and the above cycle of operations is repeated.

There are no moving parts in this flush tank to become disordered and its action is most efficient.

The importance of sudden flushes is well recognized by sewerage engineers. Indeed, the gradual trickling of a stream of water in a sewer has almost no effect, whilst the sudden rush of a body of water at intervals is most efficient as a means of keeping in order a system of drainage. Hence it is important that when small quantities of water are available they should be stored in some such tanks as we have here described, and allowed to escape in bulk. By such means very small flows of water may be given the best possible effect. — *The Mechanical World.*

Good Roads.

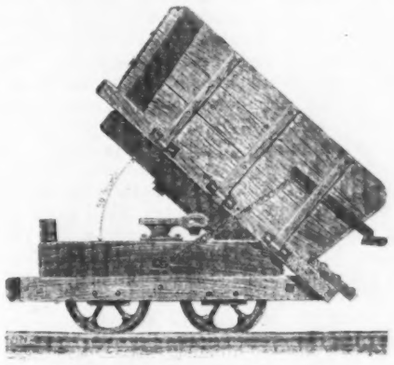
It might at first thought seem unnecessary to speak of the importance of good highways to farmers who have much heavy teaming to do; and yet in how many sections good roads are the exception rather than the rule. Our highway taxes are not worked out by the job, but by the day, or even worse yet, by the hour, and too often the hours pass rapidly away with little benefit to the path under repairs. This should not be so, and farmers are more interested than any other class in having it otherwise. A team can readily draw over a good track a load one-quarter heavier than it can pull over a poor one, and with less wear and tear of vehicles and the patience of the driver. Suppose you could, by some economy, secure for twelve months' pay fifteen months' service of your hired man. How noticeable the saving would be. Suppose the idea were not to save, but to keep from increasing expenses only. On how many roads might a man and team work for three months in making repairs and improvements, and then in twelve months haul more weight than would have been possible in the whole fifteen without those repairs and improvements.

Look at the matter from another point of view. How often do we see nearness to a market or railroad station mentioned as a great advantage of certain land offered for sale. On a good road a horse will travel the distance more quickly than on a poor one, so that improving a road is not only enabling you to take larger loads, but is also in effect moving your farm just so many minutes nearer the market or station. Extensive repairs will be necessary this spring, on account of the damage done by the late flood. Let there be system in these repairs. If possible, secure the adoption at spring town meeting of a better plan of highway management. Have taxes payable in money, as a rule, with larger districts placed under the charge of your most competent men, fairly paid, that good service may be required at their hands.

In repairing bridges one point is worthy of notice. Those bridges, which were a little above the level of the road on either side were relieved from the most disastrous effects of the flood by having a large share of the water pass over these lower places; while where the bridge was on or below the general level, it bore the full brunt of the tremendous current; of the former very few; of the latter, nearly all were carried away. In some places, where an expensive bridge does not seem to be warranted, a wooden structure has some advantages over stone. For instance, the town of Exeter has sometimes been considered rather backward in improving its bridges, which are largely of wood. Many of them are carried away, swinging from one end, and floating down stream a short distance, where they lodged against the bank. When the water began to subside, the surveyors towed them back, in some instances merely anchoring them until the waters, falling, left them in their original position, comparatively uninjured. When stone bridges are swept away they must be thoroughly rebuilt, so it will readily be seen that for positions of not too great importance the wooden structure has some advantages. Moreover if carried away while some one happened to be crossing, he would prefer to be on a wooden bridge. Another lesson of the flood is that those districts in which the gutters and conduits were well looked over and put in good condition just before winter shut in, suffered far less than others where weeds, stones and wash from the path had been left to obstruct the gutters and make the road-bed preferable as a path for the water.—Woonsocket, R. I., *Patriot.*

The Dump-Car of Caizerque Bros.

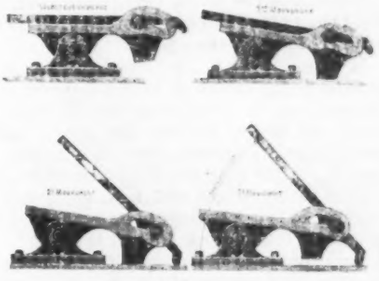
The contractor's dump-car, illustrated above is shown at the Exhibition of Contractors Plant at Paris, and is reproduced from *Le Genie Civil* of February 28th, which contains descrip-



Contractor's Dump-car.

tions of a number of other cars of like purpose but generally somewhat too complicated and expensive for our use.

In this car the dumping device gradually displaces the car-body from its normal position by three successive movements. The mechanism is in three pieces made either of cast-iron or steel. The first piece forms a support with two jaws and a connecting pin; it is



Dumping Device.

bolted to the wheel-frame. The second piece has a lug fitting between the jaws and terminates in a heel or rest; the third part, of peculiar form, revolves around a pin in the elongated eye in the end of the second piece; it is fastened to the car-body. Figs. 2, 3, 4, and 5 show the various movements of these numbers.

The chain shown in Fig. 1 limits the movement of the car-body in dumping.

Railroads in Italy.

The law of July 29, 1879, appropriates the sum of $11,199,820 for new railroads; of this amount $10,599,820 are for construction, and $600,000 for equipment. The law provides that the provinces and parties locally interested shall contribute to the cost of building new railroads; these contributions are enclosed in the above amounts; they amount to $1,049,800, so that the Government pays $10,150,020. The more important railroad lines and the amounts provided for them are:

Rome—Solmona—Aquila	$1,200,000
Parma—Spezzia, with a branch to Sarzana	1,080 000
Faenza—Florence	800,000
Terni—Rieti—Aquila	600.000
Reggio (Calabria)—Paola—Castrocucco	2,800,000
Aosta—Ivrea	222,250
Auxiliary line from Giovi, between Genoa and Alessandria to avoid a dangerous tunnel	294,420
Line to the Simplon, from Gozzano to Domodossola	80,000
Tondira—Colico—Chiavenna	125,500
Cuneo—Ventimiglia (across the (Col. di Tenda)	89,430
Belluno—Feltre—Treviso	125,340

The Use of Beechwood for Railroad Ties.

The Oriental Railroad has made trials with ties of beechwood. Several years experience proves, beyond doubt, that beech ties well impregnated with creosote or chloride of zinc last as long as pine ties treated by the same process, they hold the spikes and base of rails as well as the pine ties, but are rather preferable on account of their greater hardness. The well-known disadvantages of the beech are, that the logs, when left felled for a long period are liable to dry-rot, and that it is difficult to protect the cut ties, whether impregnated or not, from getting full of crevices before they are laid in the road-bed. To ascertain the nature of beechwood and the proper time to cut it, etc., comparative tests were made at the impregnating works at Sarembey, near Philipopolis, where chloride of zinc is used. The following results were obtained:

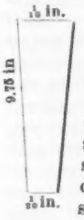
Generally beech and pine absorb about the same quantity of antiseptic fluid, (the heavier beech, however, absorbs a smaller quantity by weight.) Both kinds of wood absorb more fluid when dry, than when moist, and with both kinds the wood cut at the beginning of winter absorbs less than that cut at the end of winter. The absorbing capacity varies considerably; it was from forty to seventy-five pounds per tie. Both woods require about the same time for the absorption, and both are impregnated to the center by the use of the common system, but the beech usually a little easier.

Beech absorbs about twenty per cent. more fluid than pine; and can, therefore, be impregnated if less dry than pine.

If properly laid, the greatest part of the moisture—in excess of the humidity of the atmosphere—is soon evaporated from the newly cut as well as from the newly impregnated wood, more than one half in the first month. After that the monthly decrease of weight becomes less and less, until the full dryness of the atmosphere is reached, which is usually in ten or twelve months.

These observations proved that the ties can be submitted successfully to the impregnating process two or three months after being cut; they are then ready to absorb a sufficient amount of fluid; they proved also, that the ties can be laid in the road-bed two or three months after being impregnated. Investigations were made on the formation and enlargement of crevices in beach wood, and the remedies to prevent the same. In the first place it is necessary to lay the ties so that they are protected from the direct rays of the sun and from dry winds. Even if this is done, new crevices are formed at all times and the old ones enlarged; this occurs during the drying of the newly prepared ties, and during the process of impregnation. Most of the crevices and the largest, are formed during the time when the antiseptic fluid is forced into the wood by artificial pressure. The number of ties, rendered useless by crevices is not very large, with careful treatment about 2 per cent. which, however, is quite a heavy loss, when wood is scarce. Besides this a very large number of ties become full of small crevices, which are a great drawback to their use, as greater care must be taken in driving the spikes. If the ties are laid in a nearly dry condition, the number of crevices is not much increased.

The simplest and most efficient remedy against crevices, and especially against their enlargement, is the use of S-shaped clamps of hoop-iron. This remedy is usually applied only after the crevices have formed; as new ones are continually formed during the process of drying, additional clamps must be driven. The result is only partially successful. It is, therefore, advisable to drive these clamps at both ends as soon as possible after cutting. The accompanying sketch is a cross-section of the iron used; the pieces are 16 inches long; each clamp weighs from ¼ to ½-pound, and costs from 0.5 to 0.6-cent. The total cost for each tie is, therefore, very small. It sometimes occurs that several smaller clamps have to be driven after the impregnation, when small crevices form between the first clamps.



The above named railroad has adopted the following rules:

1. The beech logs shall be prepared soon after they are cut. 2. One S-clamp must be driven into each end of every tie. 3. The impregnation may be done two or three months after the cutting of the ties, according to the season. 4. The ties shall not be laid until two or three months have elapsed after the impregnation. 5. The ties shall be laid in strict accordance with the given rules.

The results so far obtained justify the hope that the beech ties, if prepared according to these rules, will last as long as those of pine, with either wood, two steel plates are placed, on each tie to carry the rails. This is advantageous for the safety of the traffic and the preservation of the ties.

The trees are cut in winter, the best time for cutting trees, varying according to whether the wood is to be used for railroad ties or for buildings. So far nothing has been proved which would make the winter cutting unadvisable. It has been observed that ties either of pine or beech, which were cut early in winter, required longer time to remove the sap than those cut at the end of winter or beginning of spring. The amount of sap extracted by steaming the ties was less with those cut at the beginning of winter than with those cut later; the process of steaming must then be extended. The removal of sap is more rapid with beech than with pine, and the amount of sap is also larger; being (with wood cut in the middle of winter) two per cent of the weight of a pine tie and more than three per cent. of that of a beech tie.—(*Centralblatt der Bauverwaltung*, July 11, 1885.)

The Government of Railway and Canal Traffic Bill in England.

LONDON, March 12, 1886.

The bill for the better regulation of railway and canal traffic, introduced last night by Mr. Mundella, the President of the Board of Trade, was issued to-day. Its principal object is to perpetuate the Railway Commission created under the Railway Regulation Act, 1873, to alter its constitution and enlarge its powers. The bill is confined to the subject of rates and fares, and does not touch the question of public safety. It is divided into five parts. The first relates to the constitution of the Court and the Railway Commissioners, the second to their jurisdiction, the third contains various provisions concerning traffic charges, the fourth relates to canals, and the fifth contains miscellaneous provisions. The first part of the bill deals with the constitution of the court of the Railway Commissioners. The bill proposes to establish a court to sit in England, or if the cases require it Scotland or Ireland, and to consist of a judge and two lay members. The judge will in each country be one of the existing judges of the superior courts; and the lay members are to be practical men of business who are not to sit in Parliament. All pending business will be transferred from the existing commissioners to the new tribunal, and the existing commissioners will cease to hold office.

Clause 13 provides for complaints to be made to the commission by various associations and public bodies, including associations of freighters, town councils, harbor boards, or any local authorities now existing or hereafter to be created.

Clauses 14 and 15 deal with appeals. No appeal from the finding of the commissioners is to lie on a matter of fact or on *locus standi*. On other points there is to be a direct appeal from the commissioners to the Court of Appeal with a further right to appeal (by leave of the Court of Appeal) to the House of Lords. The powers which the courts have hitherto exercised of restraining the jurisdiction of the commissioners by prohibition or certiorari are put an end to. The second part of the bill deals with the jurisdiction of the commissioners.

By clause 18 jurisdiction is given to the commissioners to hear and determine any complaint made under the provisions of a special act of a railway company of the same nature as the complaints which they entertain under public acts. By clause 19 the commissioners are empowered to settle any dispute involving the legality of any toll, rate or fare, and may award damages to the party aggrieved. By clause 20 power is given to make orders on two or more companies to enter into such mutual arrangements as may seem necessary in the interests of the public. By clause 21 power is given to the higher courts to transfer any questions which arise in railway cases for determination by the commissioners. By clause 22 rating cases may also be transferred from quarter sessions to the commissioners. By clause 23, in cases where local authorities apply for works such as a bridge over the level crossing, etc., in a town, the commissioners may apportion the expenses to be borne by the company and the applicants. The third part of the bill deals with traffic. Clause 24 provides for a revision of the classification and maxima of railway rates. This proposal is as follows:

Every railway company shall within twelve months after the passing of the act submit to the Board of Trade a revised classification of their rates and charges and a revised schedule of their maximum rates and charges. When such a scheme has been submitted to the Board of Trade and made public in such a way as may be directed, the Board of Trade are to consider and arrange with the objectors (if any) such classification and maximum rates, and if possible present to Parliament in an agreed form—that is to say, on such terms as may have been arranged between the railway company and any objectors—a provisional order containing the proposals of the companies, and this would pass into law without further opposition. If the Board of Trade, however, fail to bring about an agreement, they will themselves prepare a scheme containing what is in their opinion a fair settlement, and will embody this scheme in a provisional order. These provisional orders will be treated in the same way as other provisional orders already provided for by the standing orders of Parliament, except that they will be submitted to a joint committee of both Houses of Parliament. The proposal for a joint committee in these cases is new, and if accepted will require a fresh standing froming both houses. The Board of Trade will, in addition, make a special report to Parliament pointing out those questions which had not been agreed upon, and thereby limiting the questions which the joint committee would have to deal with—those points which the Board of Trade had failed to settle.

Clause 25 relates to the subject of undue preference. Jurisdiction on undue preferences is confined to the commissioners. It is provided that on any proof of inequality the burden of showing that it does not constitute undue preference shall lie upon the railway company, but that in deciding such cases the commissioners shall have power, in addition to other circumstance now held sufficient to justify inequality, to take into consideration whether such charges are necessary for securing traffic. The definition of undue preference is to extend so as to include "an undue preference, or an undue or unreasonable prejudice or disadvantage in any respect in favor of or against any person or particular class of persons."

Clause 26 extends the law concerning undue preference, and concerning traffic facilities to steamers owned by railway companies.

Clause 27 amends and makes more clear the existing law concerning group rates. It provides that "it shal be lawful for any railway company, for the purpose of fixing the rates to be charged for the carriage of goods to and from any place, on their railway (hereinafter referred to by the expression, the 'point of destination or departure'), to group together any number of places in the same district situated at various distances from any point of destination or departure, and to charge a uniform rate of carriage for goods to and from all places comprised in the group to and from any point of destination or departure, provided always that such group rates shall not be charged and places shall not be grouped together so as to create an undue preference."

Clause 28 provides that persons who complain of unreasonable charges may apply to the Board of Trade, and that the Board of Trade shall then endeavor to effect an amicable arrangement between them and the companies without any form of legal process or power of decision, and shall report the result to Parliament.

Clause 29 provides for additions to the railway statistics under the Railway Regulations Act, 1871.

CANALS.

Clause 30 applies the law concerning terminals to canals.

Clause 31 provides for the registration of canals.

Among the miscellaneous clauses is one giving power to locate authorities to extend their funds in prosecuting complaints before the commissioners.—*Freeman's Journal.*

Roads and Railroads in Spain.

The stage roads of Spain are divided into three classes, according to their importance. The Government statistics, published recently, give the following facts relating to these roads at the end of 1882:

Roads.	Finished.	In course of construction.	Construction authorized.	Projected.	Total.
	Miles.	Miles.	Miles.	Miles.	Miles.
Class I....	4527	108	37	44	4716
Class II...	4823	741	247	580	6391
Class III..	5258	2,178	1,297	6,375	15,108
Total....	14,608	3,027	1,581	6999	26,215
Roads of a lower cl'ss.	10,760	826	916	11,452	23,954

The Government spent during 1881 and 1882 the following amounts for the maintenance and construction of roads of the first, second and third class:

Year.	Maintenance.		Repairs.		New Constructions.		Total Cost.
	Mls	Dollars	M's	Dollars	M's	Dollars	
1881	12,556	2,361,347	6663	2,939,832	249	2,939,832	6,519,543
1882	14,385	2,391,223	2721	2,296,638	770	5,963,245	10,651,106

The length of railroads and street railroads on January 1, 1884, was as follows:

	In operation.	In Construction.	Projected lines auth'rized
	Miles.	Miles.	Miles.
Railroads for general traffic.....	4875	559	1553
Railroads not for general traffic.....	252	156	559
Street railroads.....	40	71	66

Centralblatt der Bauverwaltung.

Hektograph Pad.

Soak an ounce of Cox's gelatine in a little water over night, pour off the superfluous water and dissolve it by gentle heating in about four fluid ounces of glycerine. Pour into a shallow dish, and on cooling it should harden to a firm jelly. If it proves too soft, add more gelatine.

The ink is a strong solution of aniline blue or violet.

Draw on paper in the usual manner, and when dry press firmly on the pad face downward. On removing the paper the ink will be found to be transferred to the gelatine surface.

A large number of copies may be taken by placing sheets of paper upon the pad with a gentle pressure.

The ink can be removed from the pad by careful washing with warm water or by a ilute solution of muriatic acid—one part in y of water.—(*Popular Science News.*)

Influence of Temperature on Strength in Iron and Steel.

Some experiments on the influence of temperature on the strength of iron and steel were recently described in the *Gorny Journal*—Russian mining journal—by B. Papkoff. All the specimens tested were taken from soft steel and iron plates, three samples being cut from each plate. One sample of each group was tested at the ordinary, and two at low temperature, with the results given—"Proceedings" Institution of Civil Engineers—in the following table:—

Materials tested.	Temperature. Fah.	Ultimate strength in tons per sq. in.	Percentage of elongation in 8 inches.	Time of exposure to cold.
Three strips of dephosphorised steel plate	+63½	22.73	25.9	—
	— 2	23.75	25.5	1 hrs
	— 2	26.10	27.6	3 ½hr
Three strips cut out of iron plate, length with the grain	+63½	17.91	10.1	—
	— 2	20.00	14.0	2 hrs
	— 2	19.30	16.3	2½ hr

Both the ultimate strength and the percentage of elongation increases very sensibly with the decrease of temperature, a result which was to be expected because the greater rigidity due to contraction caused by cooling, makes contraction by mechanical tension more difficult; but this may be true only under increasing tension gradually imposed, and may not apply at all in case of impact.—*The Engineer.*

Electric Tramways in Berlin.

Some experiments have lately been made in Berlin with a new and improved system of working street tramways by electricity, which, it is said, offers great advantages in comparison to other known methods of tramway service. The necessary moving power can be regulated with the utmost accuracy, in accordance with the work to be done. The position of the two small movers (motors) has simply to be arranged differently as a larger or smaller weight has to be carried; they may either be placed in electrical fashion one behind the other, abreast, or totally separated; and the whole process requires only the action of a simple shutter and lever. This system not only admits of different degrees of power and speed, but it also benefits the accumulator by reducing its wear and tear to a minimum. When the carriage runs down an incline the electrical moving power is entirely stopped, as the train proceeds by its own weight, whereas if drawn by horses the animals have to run with it quite uselessly. A second advantage is the speed of the electric train, which can safely be increased to twice the rapidity of tramcars drawn by horses. The electric car can, it is claimed, pass the sharpest curves, and run over ground rising to 1.15, as its moving power can be raised to sixteen horse-power. A third benefit is gained in avoiding the ordinary relay of horses, and the following advantages are claimed in addition to the above:—

The electric train runs with the same safety and speed in favorable as in unfavorable weather, whereas during the winter months the frequent prevalence of snow and ice impedes the movement of horses, and makes them often fall down, whereby the traffic is naturally delayed, or now and then stopped altogether. The electric car develops neither heat, soot, nor steam, and is, therefore, preferable to steam engines. By breaking the electric current and making use of the hand brake the car can be stopped instantly, at whatever speed it may be running; thus the danger of collisions with other vehicles is minimisedl.

The construction of the cars being simple, they can be built with ease even by inexperienced men. The four lamps in the car—representing a total illuminating power equal to eighty candles—give sufficient light to enable passengers to read comfortably during their journey. Any carriage used on horse tramways may easily be converted into an electric car. Considerable economy is effected in the cost of maintenance of the road, as the electric system causes no depreciation to the street cover (wood, asphalte, etc.,) its car not coming into contact with it, whereas the pavement is naturally greatly damaged by the tram-car horses. The space required for an electric station is much smaller than for stables and other necessary accommodation for horses. The working expenses of electric cars are less than half of that for cars drawn by horse-power, consequently, the originally invested capital may soon be redeemed.

The following is a comparative calculation, based upon sixty cars, working daily twenty hours (from 5 A. M. to 1 A. M.), the longest hours on record in tramway traffic. (*a*) Capital required for horses fit for tramcars.—Each animal being four hours a day at work, a twenty hours service necessitates five pairs of horses for each car, and including a reserve of ten per cent. for sixty cars.—660 horses at £43 4s. each, £28,512; harness, blankets, etc., £2,750; total, £31,262. (*b*) Capital required for electric service.—(1) Steam-engines (750 horse power including reserve), £7,500; (2) boilers, £4,000; 8 dynamos (of which two in reserve) at 400 amperes and 150 volts each, £2,800; 140 batteries for accumulators at £90 each, £12,600; cable, £1,100; electric movers for the cars, £6,000; total, £34,000. (*c*) Working expenses.—Service by horses.—(1) Daily wear and tear for one horse, 0.4840s.; (2) food at the lowest price, 1.5720s.; (3) hoofing and attendance, 0.1613s.—2.2173s; or for 660 horses in 365 days, £26,707; renewal of harness and repairs, £722 14s.—£27,429 14s. (*d*) Working of electric cars.—24 hours loading require 18,000 hours of horse-power, or 6,570,000 a year; estimating the consumption of coal at five pounds per hour, and 0.02 shillings in value (the price of coals in England would exceed this estimate by about twenty-five per cent.), the annual cost would be £6,570; further twenty per cent. for depreciation and renewal of accumulators, £2,520; twenty per cent. depreciation of motors, £1,200; ten per cent. depreciation of boilers, steam engines and dynamo, £1,430; repairs, salaries, wages, acid, grease and sundries, £1,180—£12,900. Whereas the capital required for electric tramcars exceeds the necessary outlay for service by horse-power, the working expenses of £12,900 for the first system compare with £27,429 14s. for the latter, showing a saving of not less than £14,529 14s. a year.—London *Railway News.*

How To Advertise.

An exchange, in some "hints on advertising," says: "Another thing which publishers have to contend with is that the results of advertising are not always visible to patrons, many of whom cannot understand why custom cannot be directly traced to the source where they expended their money to obtain it. Business is like a river with many tributaries, and in which it is impossible to trace every individual drop of water to the spring from whence it came. But if a journal is selected for advertising purposes that reaches time and again the persons most likely to be interested in the solicitation that paper is certainly a sure fountain-head of profitable trade in the stream of patronage far below. Temporary advertisements in a small way will not produce an immediate or permanent increase of buisness any more than a light shower will affect the depth of water in a well, but by persistency in the use of printer's ink in the right direction the results sought will be gained in the end with interest."

ENGINEERING NEWS
AND
AMERICAN CONTRACT JOURNAL.

TRIBUNE BUILDING, - NEW YORK CITY.

THE ENGINEERING NEWS PUBLISHING CO. PROPRIETOR.

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THE *Pall Mall Gazette* says that an enterprising American syndicate has set up in China a complete working model of a railroad; including 100 feet of main-track and siding with switch and turntable, a passenger locomotive and tender, mail and baggage cars, a Pullman parlor and sleeping car, and various types of freight cars. The cars are 5 feet long, and the other details in proportion, even to the locomotive which is said to be driven by clock-work.

Engineering, in commenting on the above, commends the energy and shrewdness of the American engineers in sending out a working model of a railroad to a likely purchaser. But it expresses a fear that now that Li Hung has got his model, he will think that China does not want to be subject to foreign nations for its railroads, and Chinaman-like will build to a full scale after his model, even to the clock-work in the locomotive.

Work at Flood Rock.

The *Evening Telegram* says that the Atlantic Dredging Co., of Brooklyn, have three dredging boats at work at Flood Rock, and that they are removing the debris at the rate of about 2,000 tons per week. The largest boat averages about three or four scow-loads per day, of about 230 tons each; the others average two or three loads each.

According to the report the surface layers, at least, of the rock were not much affected by the original blast as surface blasting with 50 lb. cans of dynamite is resorted to from one to three times per day. The rock dredged is entirely the rock broken by these surface blasts.

It is noted that blasts fired on the Nigger-head reef cause very considerable vibrations on the New York shore; while blasts on the main reef are not felt at all in New York, but have cracked walls and broken glass in Astoria. This is the more peculiar as the natural stratification of the main rock seems to tend towards the foot of 89th street in New York. At the present rate of progress it is estimated that there will be 18 feet of clear water at low tide in the middle channel, between Flood and Mill Rock, by June 1, next. After this channel is secured the dredges will concentrate their energies on the main reef.

The American Exhibition in London.

We have been shown a letter from the editor of one of the engineering papers in London, saying of this proposed exhibition, for next year: "Its prospects seem more encouraging than at any time. The anomaly of an English director for an American Exhibition no longer exists, and the (spread) *Eagle* is to be published in New York from the office of the *Graphic*."

The New England Rainstorm of February 10-14, 1886.

Winslow Upton, in *Science* of March 19th, presents a valuable contribution on the subject of the rainfall of Feb. 10-14, 1886, in New England. After minutely detailing the attending meteorological conditions he describes this remarkable rainstorm. The region of greatest rainfall included the States of Massachusetts, Rhode Island and Connecticut. In a section covering more than one-half of Rhode Island and the south-eastern portion of Connecticut over eight inches of rain fell on February 11-13 inclusive, the maximum amount for twenty-four hours being 6.66 inches. West and east of this region the amount diminished rapidly, 2½ inches falling at Cape Cod and less than one inch in north-western Massachusetts. Mr. Upton estimated that within the time and limits given, the total amount of water falling from the clouds exceeded 750,000 million of gallons. Including land surface only, the result of the observations would show that 8 inches fell over 750 square miles; between 7 and 8 over 750; between 6 and 7 over 1,500; between 5 and 6 over 1,850 and between 4 and 5 inches over 2,750 square miles.

To augment the volume of water passing into the streams, that was at the beginning of the storm from 2 to 15 inches of snow and ice on the ground which was entirely melted, and safe estimates put this at an equivalent of two inches of water additional as obtained from this source. The destruction caused was widespread and can hardly be estimated.

This record of rainfall exceeds anything in New England, excepting one of October 3-4, 1869, in Connecticut, when 8.43 inches were reported for Hartford; 8.44 at Colebrook; 9.37 for Middletown, and 12.35 inches at Canton, all in a single storm.

Settling an Old State Boundary.

The Legislatures of Massachusetts and New Hampshire have finally, by the appointment of a joint commission, concluded to settle the disputed northern boundary of the State of Massachusetts, which has been in controversy since the days of King George II.

Early in the seventeenth century the Province of Massachusetts Bay practically claimed everything north and east of her, including the present States of Maine and New Hampshire. This stupendous claim was moderated as years rolled by, and in 1740 she had settled upon a line well up towards the head-waters of the Merrimac river near the present town of Franklin, N. H. Old Governor Belcher of Massachusetts stubbornly refused to budge an inch further southward, and to settle the dispute, the authority of King George II was invoked. The deliberations resulted in the following royal decree settling the northern boundary of Massachusetts for all time, as it was then supposed:

"*Decreed*, That the northern boundary of the Province of the Massachusetts Bay are and be a similar curved line, pursuing the course of Merrimac river, at three miles distance on the north side thereof, beginning at the Atlantic Ocean, and ending at a point due north of a place in the plan returned by the Commissioners called Pautucket Falls, and a strait line drawn from thence due west, cross the said river till it meets his Majesty's other governments."

Massachusetts naturally was not satisfied with this ungrammatical decree, and refused to join her neighbor, New Hampshire, in making the survey. But in 1741 the latter Province undertook the work of defining the boundary line for herself as fixed by the Crown, and from the imperfect manner in which this line was run, arises all the trouble of subsequent years, which is only now to be finally settled.

Gov. Fletcher, of New Hampshire, employed a surveyor named Hazzen to do the work and run the "straight line" due west from Pautucket Falls. Hazzen failed to make proper allowances for variations in his compass needle and drew a line which diverged northward from the true west line. The result was that when he reached the Connecticut river he was between two and three miles north of the parallel on which he started, and when he joined New York he was four and an eighth miles too far north. The very respectable slices of territory thus taken from the adjoining Province and added to Massachusetts include a number of towns whose inhabitants have been, for a century and a quarter, in doubt as to what States they really owned allegiance.

The running of the straight line was the only part of the work done until 1826 when Gov. Levi Lincoln, of Massachusetts, was appealed to by the authorities of New Hampshire to join with her in fixing the curved line to follow the course of the Merrimac, Gov. Lincoln declined, like his remote predecessor, and New Hampshire again concluded to run the line for herself in accordance with the royal decree of 1740. A surveyor by name of Mitchell then ran the curved line with results that have ever since kept the towns along the line in a turmoil as to their territorial rights and responsibilities.

Finally, Massachusetts, in 1884-85, started an investigation which was heartily responded to by New Hampshire, and the present Boundary Commission was the result. Prof. E. T. Quimby, of the U. S. Coast and Geodetic Survey is to represent New Hampshire and Mr. Spofford is to serve in the same capacity for Massachusetts, and they will begin work at once.

The survey to be made is for information only upon which the Commissioners can make a report and adjust the dispute, though the Supreme Court may be called upon for final determination. It is hardly probable that New Hampshire will recover the 50 or 60 square miles of territory she claims; but if her right is established, Massachusetts may be compelled to pay her a satisfactory indemnity.

Progress on the New Croton Aqueduct.

The Ingersoll Rock Drill Co. has issued a second elaborate report on the progress made in the headings of the New Croton Aqueduct tunnel, extending the record from November 1, 1885, to March 1, 1886. In the last four months 25,993 lineal feet of tunnel have been driven, making the total, to the date given, 49,638 lineal feet. This report is taken from the official returns of the division engineers and may be relied upon as correct; parties interested in the comparative progress can obtain from the company named the full detail.

The Ingersoll Co., with proper business enterprise, use the record to exhibit the work done by their drills; showing that in the four months mentioned a "monthly average drive" as high as 231 lineal feet had been attained. The average monthly progress in the four months on the entire line (45 headings worked continuously) was 142.6 feet, and the average monthly progress in the ten best headings using the Ingersoll drill exclusively was 196.7 feet.

Rumored Terminal Arrangements of the Baltimore & Ohio Railroad.

There is a rumor that the Baltimore & Ohio Railroad Company, not content with their Staten Island terminus, propose tunneling under the "Narrows," passing through or back of Brooklyn, and under the Sound to Port Morris, where they will connect with the New England and Elevated railroads. This scheme calls for about sixteen miles of tunnel, and its estimated cost is from $28,000,000 to $30,000,000.

As according to Mr. Gratz Mordecai's "Terminal Facilities of the Port of New York," the capital now invested in terminal stations, etc., by the various roads centering here, is $35,000,000 it may seem that an expenditure of $30,000,000 by a single road is a disproportionately large sum, but a consideration of the facts will show the soundness of the plan. Of the trunk lines reaching this city the Baltimore & Ohio has the smallest capital account per mile and hence, is the best able of any to bear the outlay and the proposed improvement which by connections with other roads will give a continuous railroad from Spuyten Duyvil to Weehawken, will very nearly complete a "belt" line around the city, taking in a present population of about 2,380,000, and will be in position to serve those suburban portions of the city which from this time on will increase in population and factories most rapidly.

The Future of the Panama Canal from two Stand points.

The *New York Tribune*, of March 30, has a special dispatch from Paris detailing an interview with Count Ferdinand de Lesseps. The Count is represented as being full of enthusiasm concerning the canal; he says that from 15,000 to 20,000 men are at work, that the canal would be completed in three years and at a cost of £44,000,000 or $220,000,000. According to the interviewer, M. de Lesseps has met no unexpected difficulties, or difficulties that modern machinery can not overcome; the Chagres river does "not interrupt the canal" but its course will be changed to run parallel with the canal and be protected by a "strong wall." He says there have been no "extravagant expenditures," and that the "expense will not exceed his original estimates" and that the entire cost will not be exceeded by $220,000,000.

M. de Lesseps says the original estimate was $140,000,000, and the present estimate of $220,000,000 includes interest on loans until completion of the work, and the expenses of administration in Paris and Panama. He says there are now twenty-three contractors on the work; that it costs from twenty-five cents to one dollar per cubic metre to excavate the material and that about 80,000,000 cubic metres remain to be taken out. The rather extraordinary statement is made "that the worst part of the work is already done, and the most difficult section of the work is completed." Mr. Nathan Appleton, who was with M. de Lesseps says the death rate was only sixty-five in 1,000, and that workmen are paid about $1.50 per day and some as high as $2.00 and $3.00. Mr. Appleton also thinks the work is going on very satisfactorily, and that the canal can be finished in three or four years.

As an offset to the above very sanguine report upon this important canal project, we have the lately published work of Commander Lucien N. B. Wyse, who claims to have been the originator of the plans and routes adopted and was the negotiator of the concessions obtained. Commander Wyse goes very fully into the various schemes proposed for crossing the Isthmus, illustrating his text with admirable maps of that part of Central America. He says that in October, 1885 about 17,000,000 cubic metres of material had been moved, of which only about 12,000,000 were from the canal proper; there has been much extravagance in buildings, gardens and farms about headquarters and the building of roads which have little value save as pleasure drives for idle employés.

Mr. Wyse says considerable work has been done on the Atlantic side and the best organized work is at Emperador; but at Culebra, the most important part of all, little progress has been made in proportion to the vast quantity which is yet untouched. He claims that by an injudicious deviation from his location the depth of the Culebra cut has been increased from 80 metres to 109 metres, and that the protection of the canal from the dangerous floods of the Chagres river by means of a dam and a large storage reservoir, has not yet even been definitely decided upon as to plans. He defines the present administration as one devoting itself "to the fastidious gathering up of papers," in other words, one much given to official routine reports and documents, but doing little work.

The author claims that the company has received one-half of its company stock (150,000,000 francs) besides 400,000,000 francs in obligations of three different types. It has on hand about 60,000,000 francs and the half of its capital, or 135,000,000 francs ($27,000,000) to pay for excavating 88,000,000 cubic metres of material. Judging from the work done, 4,600,000,000 francs and 36 years of time would be required to complete the canal. But the preliminary work, acquiring of property and collection of tools must be considered. He thinks 150,000,000 francs have been wasted in useless work, and absurd contracts, and extravagant prices and that errors of judgement on the part of the direction will amount to a loss of 350,000,000 francs by the time of completion.

Commander Wyse still maintains that his original estimate of 105,000,000 cubic metres is the quantity to be moved, provided the useless plans for the deviation of the Chagres and the formation of a vast interior port near Corrozal are given up; he would advise the building of one large dam and a number of smaller ones along the Chagres river.

To complete the work in six years, he estimates, with a reform in the methods of work, 484,000,000 francs ($96,800,000) for the excavation of 88,000,000 cubic metres at 5½ francs ($1.10) per metre, 75,000,000 francs ($15,000,000) for accessory works, and 100,000,000 francs ($20,000,000) for discount, interest, etc.; or, 600,000,000 francs ($120,000,000) in all, allowing for certain savings.

The author again calls attention to his alternative plan of introducing ten or twelve locks as offering a cheaper and quicker solution of the problem the company is now engaged in.

America Urged to Build her Own Ships and Great Guns.

The Select Commission on Ordnance and Gunnery appointed July 6, 1884, are ready to hand in their final report,

The Commission has been taking testimony at various manufacturing points with a view to ascertaining the capabilities of our manufacturers, and the results may be summarized as follows; (1) A steel gun over 8 inches calibre cannot be made in the United States to-day, and (2) various companies are willing to undertake the making of guns of the largest calibre provided they receive "sufficient remuneration." The whole question of all-steel high-power guns hinges on what is "sufficient remuneration." The Bethlehem Iron Co. wants contracts covering an annual output of 6,000 tons for five years. The Tredegar Co., 1,000 to 2,000 tons per annum "for a long period of years." The Cambria Iron Co., 2,000 tons for a period of five years. The above are all for guns up to 16-inch calibre. For calibre up to 10 inches the Midvale Steel Co. requires an order of 3,000 tons for one year; and to 12 inches, an order for 5,000 tons in gross. The figures furnished by the Midvale and Cambria Cos. are about $800 per ton. These firms believe they can make the 16-inch 100-ton guns, but the risk of failure is great, and the men must be trained and educated; success can only follow actual experience and trial.

The report of the Gun Foundry Board shows that the cost of a complete plant for turning out guns up to 100 tons, exclusive of buildings, would be about $560,000. As the Cambria Co. wants an order for $8,000,000, it can be seen that there must be a wide margin of profits to cover risks. The Commission thinks that the readiness of American manufacturers of high standing to undertake such contracts is a proof of their enterprise and skill, and the Commission is convinced that the benefits and advantages of doing this work in the United States will more than compensate for any probable increase in cost; but the members also think that it would be only prudent to commence with the manufacture of the smaller guns and work gradually towards the larger sizes, instead of aiming at once at the extreme calibres. Therefore the Commission has no hesitation in recommending that all guns for the army and navy, including those needed for the fortifications, should be constructed in the United States.

Should Congress conclude to appropriate money for guns up to 12-inch calibre, the Commission thinks it would be advisable to divide the money between two firms at least; to give the whole amount to one would be to create a monopoly, while with two firms the risk of bankruptcy, etc., of the firm would be lessened, and the competition would be likely to bring about better results in details and product.

The Commission then considers the plan of having the rough material provided by private enterprise, and the building up and finishing of the guns to be done in Government shops. In selecting a site for such a Government establishment, the following conditions should be considered:—Freedom from capture by a hostile force; proximity to the private establishments; facilities for transportation by water and rail; proximity to centres of skilled

labor, machinery, supplies and fuel, and finally the utilization of existing resources of the Government with a due regard to economy. In conclusion the Commission states that the United States possesses facilities within its own boundaries sufficient to make any guns required, provided enough money be appriated to enable either private individuals or the Government, or both combined, to set about the work.

As to the production of modern armor, the present capacity of the United States is lower than its power to obtain guns; as there has been some encouragement for the construction of the latter, but none for armor. From the testimony, a plate 12 inches in thickness is the present maximum of American manufacture; but several firms are willing to undertake the fabrication of armor of any required thickness, provided the price paid is sufficient. None of the firms questioned, however, give any definite figures as to what this price should be. Mr. Bispham, of the firm of W. H. Wallace & Co. of New York who have imported plate for the Government, states that exclusive of the mines a complete plant would cost from $2,500,000 to $3,000,000; and that an annual contract of $3,000,000 for five years would be necessary to induce a manufacturer to go into the business. According to his statement armor 12½ inches thick costs $300 per ton, and 20-inches thick $500. The only definite proposition received by the Commission was from Benjamin Atha & Co. of Newark, New Jersey, who would want an order of 5000 tons per annum for five years at $500 per ton, or a total of $12,500,000.

Owing to the vast expenditure involved, the Commission prefers to make no recommendation, but leaves the whole matter to Congress for a thorough discussion.

The Commission believes that the largest steam engines and steel and iron war ships can be built in this country in several of the navy yards, and in private establishments already in operation. If any large number of vessels are to be at once built the Government will have to resort to both its own and private yards. Steel and iron war ships can be built in the navy yards at Boston, New York and at Norfolk; and from the testimony presented, the most favorable site for their construction is on the Delaware river.

The report is submitted to the Committees on Naval Affairs and Appropriations.

Country Road Metal.

Mr. J. Ouseley Moynan, in a paper lately read before the Institution of Civil Engineers of Ireland, gives some good advice on the size of stone proper to use in surfacing country roads and the best manner of employing it.

He says that in most Irish counties the stones are specified not to exceed 2 inches in diameter; while some surveyors specify 1½ inches as the largest permissible size. The difficulty lies in getting contractors to break stone even as small as 2 inches, the general average through the country being nearer 3 or 3½ inches than 2 inches. The contractor does not seem to understand that a cube yard of stone broken to 1½-inches will cover from twenty-eight to thirty square yards of road surface, while 3 inch fragments will only cover fourteen to fifteen square yards.

The author believes 2 inches is the best size, and anything smaller is a needless expenditure of labor. Few country roads require a greater amount of metalling than is sufficient to coat them 1 inch thick each year. With 2-inch stone such roads can be surfaced once in two years.

As compared with large stones, the smaller sizes bond better, are not so liable to be disturbed by horses' feet or by wheels, and form a smoother and more even surface.

The usual practice of spreading a large quantity of stone during a couple of winter months is neither good nor economical. It makes rough roads and encourages neglect on the part of the contractor, who having done, as he supposes, the principal part of the work, leaves the road to itself for the rest of the year. The spreading of road metal should be done when and where required, continuously through the entire winter, and the wet periods of summer. The stone should be spread in good sized patches, not too small—as this causes vehicles to bump and wear holes—nor too large, as vehicles are thus induced to go in lines and form ruts. It should be spread in patches varying from one and a half square yards to nine square yards in area, and placed on alternate sides of the road to cause traffic to beat across the entire surface.

The Manchester Ship Canal.

Mr. Lyster, M. Inst. C. E., on March 10, read a paper before the Liverpool Engineering Society on the Manchester Ship Canal. He showed that the scheme of connecting Manchester with the sea dates back to 1712, and he then proceeded to discuss the objectionable features in the design of last year, going into the detail of the topography which he thinks should have controlled the location. Mr. Lyster says that the plan, as adopted, will deprive the bar channel of scouring power, and do the same for a considerable section of the river above Frodsham Shore; that a mean velocity of 5½ miles per hour and a maximum of 6¾ miles will be brought about in the canal rendering it completely unnavigable at times, and that the outer locks at Eastham will necessarily be used entirely as locks, seriously crippling the working capacity of the canal. This paper is to be discussed at a later date.

Construction in Earthquake Countries.

John Milne, F. G. S., Professor of Mining and Geology in the Engineering College of Tokio, Japan, lately contributed to the Institution of Civil Engineers a paper upon the above subject from which we make the following abstracts:—

As a result of his observations he finds that at some place in the whole Empire of Japan there is at least one earthquake per day. At Tokio, in the last ten years, there have been from thirty to eighty disturbances in a year; some of which were simply tremors, others overturned chimneys and unroofed houses. The buildings of Japan are of three classes, viz.: brick-and-mortar buildings as in Europe, the light wooden houses of the Japanese and buildings strongly bound together with cement and iron rods.

Generally the earthquakes which produce effect on buildings commence with tremors of small amplitude and short periods, appearing like surface-waves or ripples. After the tremors, usually lasting ten or twelve seconds, comes the shock. If this has an amplitude of 0.98-in. and a maximum acceleration of 20 to 23½-in. per second, brick chimneys are in danger of being cracked. The amplitude and period are measured by seismographs. The phenomenon terminates by a series of irregular vibrations resultant on the first shock, together with usually two or three other shocks succeeding at intervals of a few seconds. The direction of motion is generally in ellipses, paths like the figure 8, spirals and a complexity too intricate to describe. All the motions referred to are horizontal ones, the vertical motion being so small that it may usually be neglected.

As a result of a series of experiments near Tokio, on varying ground, it was found that relatively high and hard ground was much more suitable for building sites than soft ground. At Tokio there was least motion on the hills; but this rule appears to be reversed at Yokahama. The authorities of Tokio are now discussing the feasibility of making a seismic survey of all parts of the city where it is intended to erect large and important buildings.

In regard to the prevention of destructive motion in buildings, the author describes a house 20 by 14 feet, built of timber, with shingle roof, plaster walls and ceilings, which stands on 10-in. shells. These balls rest on slightly concave cast-iron plates fixed on the heads of piles, and attached to the building on similar plates covering the balls. Thus far, for over two years this foundation has successfully eliminated all destructive action.

To increase the rolling friction 8-in. shot were next used and then 1-in. shot. The last attempt was to support the building on each of its six piers upon a handful of ¼-in. cast-iron shot resting on flat plates. Experience shows that a shot of the kind last described is cracked by a steady pressure of 0.8 tons; as a result of this trial it was found that the waves noted in the house were practically nothing compared to those observed outside, and he recommends this construction for light one-storied buildings of wood or iron.

In regard to brick structures, an examination of 330 brick buildings in Tokio shows that the cracks seen are mainly if not entirely due to horizontal motion. Flat arches meeting the abutments at an angle crack at the angle; while arches rounding into their abutments are very usually safe. In high walls or towers, Prof. Milne says the openings for windows, etc., should not be in a line over each other but alternately, as these openings are a line of weakness.

An important rule is to avoid coupling together two portions of a structure which from their positions are likely to have different vibrational periods. As an example, he notes a case in 1880, in Yokohama, where a moderately high chimney was supposed to require support, and was therefore connected by an iron band to the side of a neighboring building. When the earthquake came, the band cut the chimney in two instead of supporting it.

The system of horizontal and vertical tie-rods running through a building, as in the City Hall of San Francisco, has been tried in Japan with success. In Japan, chimneys are now built without caps, and weighty tile roofs are avoided, both the heavy caps and the roof tending to rupture the structure under a sudden horizontal motion.

In conclusion the author says that if the ground is soft the house might rest on cast-iron shot not larger than buck-shot. Angle-iron and sheet iron with internal walls of wood and paper can be used for inexpensive buildings. Chimneys can be made of iron tubing with an external air-space made by using two tubes. Heavy brick and stone structures should have deep foundations. Motion which is visible on a level is not visible at the foot of a bank 10 feet deep; at this lower level, however, at the distance of about 100 feet the lost motion reappears. Hence a building only partially surrounded by openings like ditches, moats, steep valleys and the like may be in greater danger than if these did not exist, as the earth vibration, approaching from the side not cut off, might make the opposite side,

where the motion reaches the excavation, a free surface which would then swing forward like the last truck in an uncoupled train struck at the other end by an engine.

In the construction of a building the most important principles to be followed are: First to provide against horizontally applied stresses; secondly, to allow all parts of the building having different vibrational periods to either have freedom of motion each, or to tie them with long rods of steel or iron, especially at floors and near corners. Thirdly, to avoid heavy superstructures.

PERSONAL.

ROBERT MEEK is appointed Superintendent of Transportation and Construction of the Chesapeake and Nashville Railway, with headquarters at Gallatin, Tenn.

JNO. T. STEVENS, C. E., late of Canadian Pacific has been appointed Division Eng'r of C. M. & St. Paul Railway from Ottumwa, Ia., 68 miles southw st on Kansas City Extension—Headquarters at Ottumwa, Ia.

JOHN B. DOUGHERTY, civil engineer, who has been in South America for several months, has returned to his home in Wilmington, Del. Mr. Dougherty was engaged with the late M. C. Conwell in constructing railroads in the United States of Colombia.

GEN. JACOB L. SCOFIELD died at Fishkill Landing on March 27th, aged 91 years. He was born in the North Highlands, now Phillipstown, Putnam county, N. Y., on February 21, 1795. According to the published accounts, GEN. SCOFIELD had been a civil engineer for fifty years, but no particulars as to service are given.

CORRESPONDENCE.

Sewer Construction.

SEWER DEPARTMENT OF THE CITY OF ST. LOUIS,
ST. LOUIS, March 24, 1886.

EDITOR ENGINEERING NEWS:

The principal work in sewer construction to be let in St. Louis this year, will be that of Vandeventer Avenue Sewer district No. 1, which district contains 566 acres. The sewers will be

8 feet 6 inches	diameter,	2,848 feet	in length,	brick.
8 " 3 "	"	508 "	"	"
8 " 0 "	"	361 "	"	"
7 " 9 "	"	595 "	"	"
6 " 6 "	"	1,490 "	"	"
6 " 3 "	"	655 "	"	"
6 " 0 "	"	575 "	"	"
5 " 6 "	"	402 "	"	"
5 " 3 "	"	436 "	"	"
4 " 9 "	"	516 "	"	"
4 " 6 "	"	879 "	"	"
4 " 0 "	"	714 "	"	"
3 feet × 4 feet		547 "	"	"
2 ft. 6 in. × 3 ft. 6 in.		909 "	"	"
2 feet × 3 feet		11,884 "	"	"
18 inches diameter		15,022 ft.	in length	vitrified clay pipe.
15 "	"	"	"	"
12 "	"	36,010 ft.	"	"

making nearly 17 ⅞ miles of sewer to be let as a single contract.

The brick sewers will require

110,200	cubic yards	earth excavation.
7,000	" "	rock excavation.
16,100	" "	brick masonry.
350	" "	rubble masonry.
100	" "	concrete.

Engineers estimate of whole work, $250,000.

The ordinances have been passed, and the work will probably be let in April. XXX.

Southern Correspondence.

SELMA, ALA., March, 23, 1886.

EDITOR ENGINEERING NEWS:

Thinking you would like to hear what is going on in this part of the country, I send you a few items. The Selma Water Co. report that they are now ready to make contracts to supply consumers. The water supply is to be derived from Artesian wells, sunk to the upper vein of water underlying this place. There are two veins, the upper about 450 feet down, supplying pure freestone water; and the lower about 650 feet, supplies water strongly impregnated with sulphur and iron. The Water Co. have completed one well 4 inches in diameter which they will enlarge to 10 inches. This, with other wells to be sunk, will flow into a reservoir from which the water will be pumped directly into the mains.

There will be ten miles of mains, the pipe for which is already distributed, and ninety fire hydrants. The president and engineer of the company is W. H. White of New York. The city has contracted with an Electric Lighting Co., and work will begin soon erecting the towers and laying wires preparatory to lighting the entire place with electricity. The Calera Land Co. will hold a meeting on March 25th at Calera to consider the issuing of bonds for the purpose of raising $200,000 for the development of their property there. John H. Dunstan of Roanoke, Va., is the Chief Engineer of the company, and has superintended the improvements which they have already made.

Several prominent officials of the Kansas City, Springfield & Memphis R. R. were in Birmingham last week looking to the building of a railroad from Birmingham towards Memphis. They will meet the Memphis, Birmingham & Atlantic, which is now being built from Memphis to Birmingham and sell out at a profit or buy the M. B. & A., which latter course they prefer as they would then have a through line from Kansas City to Birmingham.

The building of a new County Court House is discussed here, and will result, I think, in its being done. The Y. M. C. A. will erect a $20,000 building here soon. A lot has been given and about $16,000 has been raised.

Yours truly.

S. H. LEA.

Shafts and Tunnels in the Bible.

EDITOR ENGINEERING NEWS:

In reading Davidson's Job, a few days since, I came upon the novel idea that in the opening verses of chapter XXVIII. we have a poetical account of mining by shafts and tunnels for gems and precious metals as carried on in the peninsula of Sinai, in the Hauran, in the Lebanon, and perhaps in Palestine, in the 7th century B. C., or earlier.

I have arranged the first eleven verses substantially according to Davidson and the Revised Version, only changing the position of the words in one clause, and using "passages" for "galleries" near the end.

The picture is vivid indeed of the miner swinging in the shaft while on the paths above the passers do not know of his existence. The path through the mines is described as invisible to the keen-eyed birds of prey, or to the wary wild beasts. The ancient miner must have been skilful if he could by the use of clays or cement prevent the water from percolating through the roof of his tunnel, and could keep himself dry; perhaps this is another lost art. Yours.

W.

JOB, XXVIII—I, II.

Surely there is a vein for the silver,
And a place for gold, which men refine.
Iron is taken out of the earth,
And copper is melted out of the stone.
Men set an end to darkness, [1]
And search out to the very end
The stones of darkness and of the deadly shade,
They sink a shaft away from man's abode.
They are forgotten of the foot, [2]
Far away from men they hang and swing.
As for the earth, out of it cometh bread,
Underneath, it is overturned as if by fire, [3]
The stones of it are the place of sapphires,
And it hath dust of gold.
That path no eagle knoweth, [4]
No vulture's eye hath seen it,
The proud beasts have not trodden it
Nor the fierce lion walked it,
Man puts his hand upon the flinty rock,
He overturneth the mountains by the roots.
He cutteth passages through the rocks, [5]
And his eye seeth every precious thing.
He stoppeth the streams from dripping [6]
And bringeth the hidden things to light.

[1] Referring either to the use of miner's lamps or to some form of lighting the caverns, or drifts.

[2] That is, those who walk above them are oblivious of the miners in the shaft.

[3] The mines are full of refuse like cinders.

[4] That path, or subterranean passage.

[5] Runs his heading through the rocks.

[6] He calks the roof to prevent leaking or dripping.

LITERATURE.

The Topographical Features of Lake Shore by GROVE K. GILBERT. Extract from the Fifth Annual Report of the Director of the U. S. Geological Survey, 8" × 12" p. 55, 13 plates. Washington Government Printing office, 1885.

"If we exclude from the sciences those scholastic theories deduced from suppositious evolutions of the supposer's inner consciousness, there is no science in which the engineer is not interested and from which he may not gain knowledge of facts that will be of value to him and this little brochure of Mr. Gilbert, for the writing of which he was well prepared by his studies of the shores of Lakes Bonneville and Provo which in recent pre-historic times covered the present level of the Great Salt Lake with 1,000 and 600 feet of water respectively, is replete with observations of shore carvings and littoral depositions, to which nearly every engineer can furnish some analogues.

The waters of Lake Bonneville rose and fell leaving a more or less legible record of their various stages by wavecut cliffs and wave and current deposited beaches till they reached their maximum height and commenced the erosion of the Port Neuf Cañon through which they discharged into the South Fork of the Columbia, with such rapidity as to leave the terraces and shore embankments built by the rising waters almost untouched, until the limestone floor of the Cañon established the newer Provo shore lines. Lake Bonneville extended from about 37° 35' to 42° 20' north and 111° 40' to 114° 15' west, flowing well up in Weber Cañon and submerging the railroad pass on the promontory. An intelligent study of the long dried bars, spits, beaches, and sea cliffs of this nearly lost lake, collated with observations on existing lakes has given Mr. Gilbert an opportunity to write a monograph that will give the engineer a key to many topographic features, that would otherwise be obscure, and will be very valuable to those who have charge of lake or sea shore improvements."

Indicator Practice and Steam Engine Economy. With plain directions for attaching the Indicator, taking diagrams, computing the Horse power, drawing the Theoretical Curve, calculating the Steam Consumption, determining Economy, locating Derangement of Valves, and making all desired deductions. Also, Tables required in making the necessary computations, and an outline of current practice in Testing Steam Engines and Boilers. By FRANK F. HEMENWAY, Associate Editor *American Machinist*, Mem. Am. Soc. Mech. Engs., etc. Fully illustrated. New York, John Wiley & Sons. 1886. Size, 5x7 1-2 inches, pp. 184. Price, $2.

The editor of the above work aims to so present his subject that any engineer can apply the indicator to his engine, take the diagram and make all necessary calculations and deductions from it. He uses none but easily understood terms and none but the simplest mathematics. The author is well fitted to carry out his programme, and to say that he has accomplished, in a very satisfactory manner, all that he promises is the best recommendation we can give this book. It is an excellent addition to steam literature and should be in the hands of every engineer who has an interest in the economical use of steam.

ROMAN ROADS.—The best highways in England are those superposed upon a Roman foundation. Their method of construction was a foundation of two courses of flat stones laid in mortar, upon which was put a rubble of broken stones mixed with one-third the quantity of quicklime, and well rammed; then came a mixture of bricks, potsherds, broken tiles, and one-third the quantity of lime; or gravel and the stated quantity of lime, laid on while hot from slaking, finished by a top pavement not less than 6 inches thick.

THE HISTORY AND STATISTICS OF AMERICAN WATER WORKS.

BY J. JAMES R. CROES, M. AM. SOC. C. E.; M. INST. C. E.

802.—ATHENS AND SAYRE, PA.

Athens and Sayre, in Pennsylvania, in lat. 42° N., long. 76° 30' W., are villages about a mile apart on a plain lying between the Susquehanna and Chemung Rivers, a short distance above their junction. Athens was settled in 1790, and has large iron bridge works. Sayre was settled in 1875, and is the seat of extensive iron foundries and the shops of the Lehigh Valley Railroad.

Water-works were built in 1884 by a private company, after plans and under superintendence of C. W. Knight, C. E., taking the supply from the Susquehanna River, and pumping it 220 feet into a reservoir holding 3 million gallons, built in excavation and embankment, in two compartments, the surface being 191 feet above Sayre and 200 feet above Athens.

A masonry chamber is built in the river, 140 feet from the shore, from which a 20-inch pipe leads to the pumping station on the east bank, where there is a Worthington duplex steam pump, of 2 million gallons daily capacity. The reservoir is on the east bank, and the 10-inch supply main to the town is carried under the river, which is 700 feet wide, to Sayre and thence south to Athens.

Distribution is by eight miles of cast-iron pipe of 16 to 4 inches diameter with forty fire-hydrants, 45 gates and 220 taps. There are six meters in use. The daily consumption in 1885 was 600,000 gallons. Services are of galvanized iron.

No financial statements are given.

The population of Athens in 1880 was 1,592, and that of Sayre was 729. The present population is estimated to be 5,000 in the two towns.

Howard Elmer is President and Superintendent.

WATER

T. G. EATON has made a proposition to build gas works for Sanford, Fla.

THE Aberdeen Gas Light Co. has been incorporated at Aberdeen, Miss.

THE Board of Aldermen, of Raleigh, N. C., have decided to invite proposals for water-works.

THE village of Boonville, N. Y., is to have a new system of water-works. Address, Clark Kellogg, Adams.

A STOCK company will probably be organized at Memphis, Tenn., to erect an electric light plant.

KNOWLES & SON will erect water-works at Llano, Tex. Work will be commenced at once.

THE building of water-works is being considered by the City Council, of Meridian, Miss.

THE Water Supply Company, of Norway, Me., has contracted with Henry R. Worthington, of New York, for pumping-engines for the new works.

A BILL has been introduced in the Maryland Legislature to incorporate the Baltimore County Water-Works Company.

WATER-WORKS are being built at New Braunfels, Tex. They are owned by the city and will be put in operation about May 1st.

THE water-works question is being agitated at Cambridge, Md. Several propositions to build works have been received.

D. Humbird, A. W. Gifford and James P. Newcomb have chartered at San Antonio, Texas, the People's Gas Co., capital stock $200,000.

DURING the storm at Woburn, Mass., on March 22nd., water pipes were bursted by the lighting in several parts of the town.

THE Orlando (Fla.) Gas and Electric Light Company has been incorporated by W. R. Anno, N. L. Mills, Nat. Poyntz, J. B. Parramore and T. J. Shine.

THE Ohio Legislature has passed a bill authorizing the city of Massillon to issue bonds to the amount of $150,000 for the establishment of water-works. Address, Peter Sailor, Massillon.

THE Louisville Natural Gas and Heating Company has been incorporated at Louisville, Ky., to develop and utilize petroleum and natural gas. The capital stock is to be $1,500,000.

THE Crookston (Minn.) Light and Power Company has purchased the present water-works from the city of Crookston for $20,000, has placed its bonds to the amount of $130,000, and will furnish electric light and power for all purposes.

THE Domestic Water Company, of Arapahoe county, Col., has filed articles of incorporation. The incorporators are Fred. Z. Salomon, Richard Holmes, George W. Clayton, Walter S. Cheeseman and William B. Mills, and the capital stock is $100,000.

STOCK of the Spring Valley Water Company, which has the monopoly of supplying San Francisco, dropped from 102½ to 89 in less than a week on the rumor that a number of New York capitalists and others intended constructing another system.

WRENTHAM, R. I., voted $2,800 for roads and bridges, and the water supply committee of the legislature have reported a bill to incorporate James D. Lincoln and others as the Plainville Water Company to supply Wrentham with water.

No. 12. Water Pressure in Mains of Various Cities.

COMPILED BY J. J. R. CROES. FROM SPECIAL RETURNS, JAN., 1886.

TOWN AND STATE.	Topography.	Difference of level in town.	In Business District.		Fire Pressure
			Day Pressure.	Night Pressure.	
		feet.	lbs.	lbs.	lbs.
Hingham, Mass.	undulating.	0	38 to 48	50	——
Iowa City, Ia.	hilly.	50	50	40	170
Jamestown, N. Y.	hilly.	185	60 to 70	60 to 70	150
Jermyn, Pa.	level.	0	110	125	110 to 125
Kennett Square, Pa.	slightly hilly.	90	5 to 40	5 to 40	5 to 20
Kenosha, Wis.	level.	0	32	38	45
Lambertville, N. J.	level.	0	72	72	80
Lansford, Pa.	hilly.	75	112	112	112
Manchester, N. H.	sloping.	——	62	62	——
Manistee, Mich.	rolling.	60	65	65	120 to 150
Nevada, Mo.	level.	10 to 20	40	40	75
New Albany, Ind.	level.	25	75 to 80	75 to 80	80 to 85
Oregon, Ill.	level.	0	80	80	80
Olean, N. Y.	level.	50	90	90	90
Parker City, Pa.	hilly.	200	40	45	150
Parsons, Kan.	level.	——	50	50	200
Red Oak, Ia.	sloping.	100	70	55	90 to 140
Reed City, Mich.	rolling.	——	20	——	110
St. John, N. B.	hilly.	130	20 to 52	24 to 56	5 to 63
St. Joseph, Mo.	hilly.	——	130	130	130
Tecumseh, Mich.	level.	0	40	40	40
Terre Haute, Ind.	level.	0	35	35	100
Uniontown, Pa.	hilly.	——	——	160	——
Walton, N. Y.	level.	0	85	90	85 to 90
York, Pa.	level.	30	25	——	——

THE city of Brockton, Mass., has sold $25,000 worth of 4 per cent. water bonds at $108.88, which makes net just 3 1-2 per cent.

Messrs. Gardner, Moore, Morris, Smith, Lane, Stanton, Rittenhouse and Work, and Chief Engineer Park, of the Philadelphia Gas Trust, paid a visit to Newark, N. J., recently to inspect the regenerative system of manufacturing gas there, with a view to introducing the system at the Point Breeze Works.

IN our issue of March 13th we credited the National Tube Works, of Chicago, with the contract for pipe for Charlotte, Mich. The item was incorrect as we are informed by letter of the 25th ult. from the CINCINNATI AND NEWPORT IRON AND PIPE CO., of Newport, Ky., that *they* have the contract.

THE Pond Engineering Co., St. Louis, has been awarded the contract for the entire pumping machinery plant for the Arkansas City, Kan., water-works, consisting of two compound, condensing, pumping engines of 1,500,000 capacity, together with boilers, heater, feed pump and pipe work.

WEST CLIFF, COL., March 24.—A proposition is now before the citizens of Silver Cliff which may practically reduce the indebtedness of that place to about 7 per cent. of its face amount. It contemplates the surrender of the water-works and franchise for the benefit of a part of the creditors, and the balance are provided for at about 25 cents on the dollar.

THE Kingston, Mass., water-works are being pushed. The bonds have been taken by Brewster, Cobb & Easterbrook, of Boston. The only contract will be for laying pipe. There will be eight miles of cast-iron pipe, and a reservoir of 260,000 gallons capacity; the water will be pumped direct into the pipes. The entire cost of the works will be about $40,000.

THE Philadelphia Natural Gas Company will soon begin work on its lines. It has a good many connections and small pipes to lay, but all the big lines are about completed. It is estimated that $150,000 will cover all the work to be done. The company's receipts have been largely increased of late by advantageous contracts, while the expenses have been lessened.

HARRISBURG, Penn., March 28.—A charter was issued at the State Department to-day to the United Natural Gas Company to mine for natural gas in Venango, Forest, Butler, Armstrong, Clarion, Warren, Elk, and McKean counties, and supply the gas to towns and cities in the above named counties. The capital is $2,500,000.

THE town of Hudson, Mass., has voted to petition the general court for authority to increase the water debt $25,000, and the matter is left in the hands of the water commissioners.

THE entire efflux through the sewers of Paris is ascertained to amount, on an average, to 362,000 cubic metres a day, or about 96,000,000 gallons, this being almost exactly three-quarters of the total amount of water furnished by the aqueducts and the rainfall, the other quarter being carried off by evaporation, absorption into the soil, or by flow over the surface directly into the Seine.

CHICAGO, March 30.—A startling fact in connection with the encroachment of the lake on Lincoln Park is that the whole surface of the lake is gradually rising at the rate of 4 inches per year. The surface of the water is now two and a half feet higher than it was seven years ago. Part of the lake shore driveway, where are some of the costliest residences in the city, has been washed almost completely away.

IN the 16th Annual Report of the New Bedford Water Board, we notice that the Superintendent, Mr. Robert C. P. Coggeshall, practices his good advice in giving a summary of statistics relating to his works in accordance with the suggestions adopted by the New England Water-Works Association. It is a good thing, and the example should be followed in every water-works report.

HERR BERAZ, the "spring-finder," of Munich, Bavaria, is creating some sensation by his successful determination of hidden water courses by the apparent use of the divining-rod of beach or hazel. The scene of his most signal triumph was in the Bavarian Highlands, over 1,300 feet above the sea; the commune of Rothenberg wanted water and he pointed out several places where he announced water would be found at a depth between 62 and 72 feet below the surface; after weeks of rock-blasting the water was found at the depth of 67 feet. At another place he said three water-courses were perpendicularly under one another; the first from 22 to 26 feet, the second about 40 feet and the third about 56 feet below the surface, all running in one direction, and he defined their volume. The actual results were that the first was found at 27½ feet, the second at 43 feet and the third at 62 feet below the ground. In the same manner he pointed out three springs in the grounds of the Convent of Altomünster, the results proving him exactly correct. His method and instruments are not described in the *Allgemeine Zeitung* of December 9, 1885, from which the above is taken.

THE city of Milwaukee, Wis. will receive proposals for laying 30-inch and 36-inch water mains until April 16. (See advertisement.)

THE Ossining Water Supply Co. has been incorporated and proposes to furnish water for Sing Sing from the Croton river, from the present dam to tide water, and from Indian Brook, in the towns of Ossining, Cortlandt and Yorktown. Capital stock, $200,000. The incorporators are Charles C. Hopkins, J. M. Brainard and Charles W. Knight. The Trustees are Charles W. Knight and Adam Miller, of Rome, N. Y., and G. H. Thompson, of Sing Sing. It is a mooted question whether the Village Trustees will permit them to lay their mains through the streets, or make any contract with them for hydrants.

FROM a carefully made table of "cost of repairs," it appears that in the cities of New York, Providence, Boston, Pawtucket and Fall River, there are 14,328 Crown meters, costing $303,805.25. The cost of repairs upon these meters from all causes, from 1879 to March 1, 1886, was $5,918.14, of which $3,449.03 was chargeable to frozen meters. The cost of repairs from all causes amounted to 1.95 per cent. of the total cost. And excluding the repairs of frozen meters, a class of repairs not properly chargeable to the meter itself, the cost of repairs amounted to only $\frac{1}{10}$ of one per cent. of their value. This is a rather practical refutation of the charges often made against all meters that they are "very expensive for maintenance."

THERE are in Tulare county, Cal., about 200 artesian wells. Their average depth is 450 feet, although some have been put down to a depth of 800 feet. No rock is encountered in boring, therefore iron casing is forced down the whole distance, after the auger. The quantity of water furnished by some of these wells is 247 gallons per minute, and any one well will usually water a farm of 160 acres. The water is the greatest expense in settling in this valley. The cost of putting down an artesian well varies, according to the depth, from $500 to $1,000. The rates charged for boring are $50 for the first 100 feet; $75 for the second 100 feet; $100 for the third, and proportionately for each succeeding 100 feet. The depth varies with the locality. The water rises, after a flow is reached, and runs in a continuous stream over the top of the pipe, usually rising from two to three inches above the top of the pipe, which varies from 5 to 7 inches in diameter. Small ranches of ten to twenty acres may be irrigated by surface wells, *i. e.* wells from 20 to 30 feet deep, whose water is raised by windmills. The prices of land in the artesian belt, Tulare county, vary according to location from $10 to $75, while outside the belt and unsupplied with water, land may be had for $5 per acre, and there are 100,000 acres of government lands subject to entry under the Pre-emption and Homestead laws. Improved farms, with right of water from the irrigating ditches, will command from $50 to $70 per acre. Farms near Tulare City with good buildings, orchards and wheat fields, fenced, are held at $150 per acre.—*Attleborough Chronicle.*

YONKERS, N. Y.—The city proposes to build a $200,000 trunk sewer; $35,000 is voted for extension of water mains and improvement of water-works.

The Yonkers Gas Light Co., proposes to supply its public buildings under control of the Common Council at 95 cents per 1,000 feet.

On the evening of January 7, 1885, Mr. and Mrs. R. T. Pettingill were driving through Yonkers avenue, when the horse stumbled over an unprotected embankment of earth placed on the avenue by George B. Valentine, who was working under a contract with the Water Board, in laying water pipes. Mrs. Pettingill was thrown violently from the wagon, and sustained serious injuries. She subsequently brought a suit against the city for $20,000 damages for the injuries received. The case was tried before Judge Dykman and a jury, when judgment was rendered in favor of the city. This judgment was reversed by the General Term, and a new trial was ordered. This new trial was called on before Judge Dykman and a jury recently, and the jury rendered a verdict of $16,000 in favor of Mrs. Pettingill. As the matter now stands, one Court has decided that the city is not liable, and another has decided that it is. The case is to be carried to the Court of Appeals, and if the city is compelled to pay this heavy verdict, it may be money well expended. The lesson taught is, that it is neither wise nor economic for the city to award contracts to careless, dilatory or irresponsible men. On the 18th of August, 1883, Mr. Valentine contracted with the city to grade Walnut street, and to finish the work in one hundred days. On the 28th of September, 1885, the contract not being completed, the Common Council declared it voided and forfeited, and the work was completed by the Street Commissioner. It is stated that the contract with the Water Board, to lay pipes on Yonkers avenue, was to have been finished in December. Had the contract been complied with, Mrs. Pettingill would not have been injured, and there could have been no suit against the city, or heavy damages and legal expenses for the taxpayers to shoulder. Will the Common Council learn the lesson?

On the trials J. M. Hunt acted as attorney for Mrs. Pettingill, and City Attorney Joseph I. Daly, represented the city.—*Yonkers Statesman.*

NEWS OF THE WEEK.

CONTRACTING.

Town Appropriations (Massachusetts).—Great Barrington appropriates $5,550 for highways; Dalton $2,700 for highways and bridges; Granville, $1,800 for highways; Sterling, $2,000 for repairing roads and bridges.

Stamford, Conn., Sewerage.—Under date of March 2nd, the sewerage committee of Stamford, Conn., submitted its report on the manner of obtaining proposals for a general system of sewerage. In response to advertisement, nine bids were received, ranging from $87,000 to $92,750. The bids for the removal of rock varied "for blasting or quarrying" from $4.00 to $3.12½ per cubic yard. The committee recommended that the contract be awarded to the Drainage Construction Co., of Newport, R. I., at $92,750, believing that under the conditions of work, the cost will be less by their bid than by the others, as they will blast rock for $1.75 and quarry it for $2.50 per cubic yard. Mr. Wm. B. Pierce has been employed as Inspecting or Superintending Engineer on behalf of the Borough. The following were the bids submitted:—

Names of Bidders.	For the removal of Boulders or Rock in excavation of trenches for sewers exceeding in extent ½ cubic yard. Per cubic yard.		For construction of the system of sewerage complete.
Healy & Austin	Loose rock	$3.00	$109.443
	Ledge "	6.00	
John D. Hathaway	Blasting	4.00	94,850
	Quarrying	1.00	
	Quarrying within 5 ft. of water or gas mains	6.00	
Drainage Construction Co	Blasting	1.75	92,750
	Quarrying	2.50	
	Quarrying within 5 ft. of water or gas mains	3.50	
George M. Cushing	Blasting	3.75	90,000
	Quarrying	3.00	
	Quarrying within 5 ft. of water or gas mains	4.50	
J. Robinson	Loose rock	2.00	87,500
	Solid "	4.00	
	Rock to be excavated without blasting	5.00	
Patrick Kearns	Rock excavation	3.60	87,600
G. C. Mills	Blasting	4.50	84,000
	Quarrying	3.00	
	Quarried rock that could be blasted	5.00	
James Moore	Blasting	3.50	82,900
	Quarrying	2.50	
	Blasted rock ordered to be quarried	6.00	

Dry Dock.—Cheboygan, Mich., is to have a dry dock, the boxes of which will be brought from Milwaukee. It is to accommodate vessels of 1,000 tons or over.

Artificial Stone Sidewalks.—Bids received for sidewalks at the Court House, etc., Jackson, Tenn., were as follows: Burns & Hayden, per square foot, 29 cents; Archer Harman, 40 cents; McCarthy & Corbitt, 42½ cents. All bids were rejected.

American Iron in England.—A spirited discussion took place in the London City Councils recently on the proposition to build the new Tower bridge across the Thames, of foreign iron in case it could be had at a cheaper rate than the home material.

The Burlington and Missouri River R. R. has awarded a contract for the construction of 150 miles of road northwest from Grand Island in addition to 100 miles previously let, which will bring the northwest terminus nearly, if not quite, to Chadron, Neb. The work is to be completed the present season.

Asphalt Paving.—The cost of laying and maintaining the Barber Asphalt paving in St. Louis, Mo., was $3 per square yard; and 9 cents per square yard for maintenance under a ten years contract. In Omaha, Neb., the cost was $2.98 per square yard on a five years guarantee from the company.

A Baltimore Elevated Railroad.—Oliver Brothers & Philips, of Pittsburg, Pa., have been awarded the contract for supplying the iron for between three and four miles of elevated railroad to be built in Baltimore by the B. & O. R. R. Co. this summer. The contract for the erection of the works has been awarded to C. J. Schultz, of the Iron City Bridge-Works, of Wood's Run.

Masonry and Pile Driving.—A. J. Jolly & Sons, quarrymen, Phillipsburg, Pa., have been awarded the contract for the stonework and structure of the bridge over the Little Kanawha river at Parkersburg, W. Va., for the Ohio River R. R. They also have the contract for driving piles along one mile of the road. The consideration is nearly $100,000. The stone for the bridge will be quarried near Parkersburg.

Canal Gate.—The last of the thirty-four iron gates for the Muscle Shoals Canal has been completed. These gates were commenced in December, 1884, and a force of men has been constantly employed on them until the present time. The sizes of these gates run from 8 to 19 feet and weigh from 20,000 to 40,000 pounds each. The beams of the gate are of steel, furnished by Carnegie Bros., of Pittsburg, and the plates were imported from Belgium.

Cleveland Belt Line Bridge.—The King Iron Bridge Company, of Cleveland, O., will build the superstructure of the belt line bridge, and they will receive for the work $290,700. The proposals received by the Board of Improvements were as follows:—

	per ton.
Cleveland Bridge and Iron Company	$94.98
Keystone Bridge Company	99.80
Detroit Bridge and Iron Company	95.00
New Jersey Steel and Iron Company	80.50
Union Bridge Company	76.20
King Iron Bridge Company	64.60

Rails and Bridges.—A number of Pittsburg manufacturers are bidding on a large order for steel rails and bridge iron for the Denver & Rio Grande R. R. The order will amount to nearly 20,000 tons and is to be delivered some time this fall. The order would probably have been placed some weeks ago, had not the labor troubles on the Western railroads caused a suspension of all improvement. The rails and bridges are to be used on an extension of the Denver & Rio Grande R. R.

Lumber Swindles.—OTTAWA, March 23.—Some lumbering firms have been seriously victimized by the dishonesty of some of their employés. The Georgian Bay Lumbering Company, in which Messrs. Dodge & Son, of New York, are largely interested, are said to have suffered greatly. One of their chief bush managers is charged with reporting certain timber limits as stripped when very little timber had been taken off, and buying up the land at nominal prices from the company, thus securing all the valuable timber left standing. One of the parties alleged to have been engaged in this business having been nominated for Parliament the whole transaction has been made public.

River and Harbor Bill.—WASHINGTON, March 27.—The total appropriation for the improvement of rivers and harbors, as agreed upon by the House Committee to-day, is $15,164,200. The amount provided for New York harbor is $425,000. For the Mississippi river, appriations are proposed as follows: From St. Paul to Des Moines Rapids, $560,000; Des Moines Rapids to the mouth of the Illinois River, $200,000; from the Illinois River to the Ohio River, $500,000; from Cairo to the head of the Passes, including the correction of the Vicksburg and Greenville bends, $2,225,000; for surveys of the Mississippi, between the Passes and head water, $75,000; for removal of obstructions $70,000; for reservoirs, $50,000, and for snag boats, $30,000. The bill includes appropriations for two years, as they will become available upon the passage of the bill, and continue through the next fiscal year. Among the appropriations are the the following:

New York—Buffalo harbor, $150,000; Buttermilk Channel, $75,000; Rouse's Point Breakwater, $20,000; Canarsie Bay, $5,000; Charlotte harbor, $10,000; Dunkirk harbor, $10,000; Flushing Bay, $10,000; Gowanus Bay channel, $7,500; Great Sodus Bay, $15,000; Greenport, $5,000; Little Sodus Bay, $12,500; Oak Orchard, $2,500; Ogdensburg, $10,000; Oswego, $95,000; Rondout, $2,500; Sheepshead Bay, $5,000; channel between Staten Island and New Jersey, $15,000; Hell Gate, 150,000; East Chester Creek, $10,000; Hudson River, $15,000; Newtown Creek and Bay, $50,000.

New Jersey—Raritan Bay, $30,000; Maurice River, $5,000; Passaic River, $35,000; Raritan River, $35,000; Shrewsbury $10,000; South River, $5,000.

Rhode Island—Block Island Breakwater, $8,000; Newport harbor, $12,500; Pawtucket River, $25,000; Providence and Narragansett Bay, $35,000.

Connecticut—Connecticut River, below Hartford, $35,000; Housatonic River, $5,000; Thames River, $20,000; Bridgeport harbor, $20,000; Black Rock, $5,000; New Haven Breakwater, $100,000; New Haven harbor, $20,000; New London, $20,000; Norwalk, $3,000; Stonington, $20,000.

Bridges.—The following are the bids received by Superintendent of Public Works, Shanahan, for two bridges at Lockport, N. Y.

Main Street Bridge.

Shiffler Bridge Works, Pittsburg, Pa	$12,900
King Bridge Company, Cleveland, Ohio	29,000
Niagara Bridge Works, Buffalo	19,366
Sullivan and Ehlers, Albany	18,775
O. F. Hilton, Albany (wood)	12,776
Morse Bridge Co., Youngstown, Ohio (wood)	14,840
Groton Iron Bridge Company, Groton, N. Y.	15,000
Rochester Bridge Works, Rochester, N. Y.	15,490

Cottage Street Bridge.

Shiffler Bridge Works, Pittsburg, Pa	$2,950
King Bridge Company, Cleveland, Ohio	4,782
Niagara Bridge Works, Buffalo	4,023
Sullivan and Ehlers, Albany	4,439
O. F. Hilton, Albany	3,030
Morse Bridge Company, Youngstown, Ohio	2,430
Groton Iron Bridge Company, Groton, N. Y.	2,675
Rochester Bridge Works, Rochester, N. Y.	2,490

The contract for the former was awarded to O. F. Hilton, and for the latter to the Rochester Bridge and Iron Works, the two lower bids being rejected on account of defect in the plans.

Railroads, Bridges and Canals.

The Mobile & Girard R. R. is to be extended from Troy, Ala., to Elba, Ala.

The Texas & Pacific R. R. engineers are surveying for the new line from Abilene, Tex., to San Angelo.

The Indianapolis, Decatur and Springfield R. R. is now engaged in putting in an iron bridge across the Sangamon river at Decatur, Ill.

New York & Brooklyn Bridge.—Work has been commenced on the foundations for the Chatham street extension.

The Kansas City, Fort Scott & Gulf R. R. Co. is considering the question of obtaining a charter and rights in Alabama. In such an event the line will be extended from Memphis to Birmingham.

Joliet, Aurora and Northern R. R.—Active work has been resumed between Joliet and Aurora. It is probable that the laying of the steel rails will begin early in April.

The Chicago, Cairo & Great Southern R. R. Co. has been incorporated. Capital stock, $10,000. Incorporators, Edgar D. Swift, Attee Coale, James A. Mahon, James A. Forrest and Charles T. Gregory.

Lackawanna & Pittsburg R. R.—A syndicate of New York and Philadelphia capitalists will purchase the road and extend it from Perkinsville, N. Y., where it connects with the D. L. & W. R. R., to Geneva and Sodus Bay.

The Union Elevated Railway Co. of Chicago and Cook county, has been incorporated. The capital stock is $10,000,000, and the incorporators are Edgar T. Paul, Michael W. Ryan, Philip A. Hoyne, Edward E. Swiney and Chester M. Dawes.

The New York, Woodhaven & Rockaway R. R., has had a diver at work for a week inspecting the piling of the road across Jamaica Bay. It was found to be in excellent condition. The company has commenced the work of laying 5,000 new ties and 300 tons of steel rails.

Crookston & Duluth R. R.—The surveying party is working near Devil's Lake. The route has been changed to cross the Red Lake river about three miles east of Crookston and follow the river on the north bank.

Public Works at Paris.—The Chamber of Deputies on March 20 adopted a bill authorizing the city of Paris to issue a loan for the construction of public works to furnish labor to the needy unemployed on condition that nothing but French material be used in the works.

Tunnel Accident.—On March 22nd a tremendous fall of top rock took place in the tunnel near Pottsville, Pa., on the Pottsville & Mahonoy R. R. About twenty men were buried, of whom two were killed and several severely injured.

The Montana Western R. R. has been incorporated. The line will run from Drummond on the Northern Pacific R. R. to Phillipsburg, and to some point on the Utah & Northern R. R. between Deer Lodge and Silver Bow Junction.

The Buffalo and Williamsville R. R. Co. has been incorporated with a capital of $300,000, to run from Buffalo to Williamsville, distance 10 miles. J. S. Buell, J. Tillinghast, Byron J. Tilman, C. C. Pickering, Charles Barrick and Leonard Dodge are among the trustees.

The Brooklyn Board of Commissioners of Rapid Transit are holding daily sessions at the City Hall to interview parties interested in the project.

Niagara Falls and Whirlpool Railroad.—Engineers have begun the survey for this line, which is to run along the base of the cliffs from the falls to the whirlpool.

The Pittsburg, Knoxville & Allentown R. R. Co. has been chartered to build a line from Pittsburg to Knoxville. The capital stock is $100,000,000. The Directors are William J. Hunter, of Knoxville, William Adams and F. Grimes, of Pittsburg.

A Long Island Canal.—Engineers have begun surveying the ground for a proposed canal to be constructed between Jamaica Bay and Far Rockaway Inlet, to be a mile long and 120 feet in width. When this is finished there will be a continuous still-water route from Coney Island to Shinnecock Bay.

A Navigation Scheme.—WASHINGTON, March 19.—In the Senate to-day Mr. Wilson presented a joint resolution of the Legislature of Maryland requesting Congress to appropriate money to make continuous navigation from Chincoteague bay in Virginia to Delaware bay at or near Lewes, Del.

Northern Pacific R. R. Branches.—FARGO, D. T., March 25.—A large surveying party left this morning for Helena to run branches of the Northern Pacific R. R., one from a point a little west of Helena, south down Ten-Mile Creek to Regina, in the Red Mountain district. The other to run north up Prickly Pear to Great Falls, on the Missouri river.

Chautauqua R. R.—The dispute as to the location of this line has been settled. The commission has decided that the road must follow the lake shore instead of going in the rear of the grounds up a heavy grade. Point Chautauqua wanted $80,000 for the right of way, but the commission decided that the grounds would not be injured.

The Chicago & Great Southern Railroad was sold at Indianapolis, March 27, under a decree of foreclosure, by Master Commissioner Fishback, to Henry B. Porter, of Chicago, the only bidder, for $501,111. Mr. Porter represents the bondholders. The issue of bonds amounts to $1,200,000. The road runs from Chicago to the Brazil Block coal fields.

The Wichita Falls, Abilene & Kansas City Railroad Company proposes to build a railroad from some point on Red river via Albany in Shackelford county to Abilene, Texas. The capital stock is $200,000. The object is to get an eastern outlet, either through the Kansas City and Fort Scott R. R., or the Atchison, Topeka and Santa Fe R. R.

An Oregon Railroad.—Engineers are at work on a railroad route crossing the Sierra by the Deer Creek Pass, and have nearly completed the preliminary surveys. The proposed line starts from Baker city, on the Oregon Short Line of the Union Pacific R. R., and runs through Chico to Willows, in Colusa county, and thence to a connection with the Donahue & San Francisco, Railroad.

The New York, Philadelphia and Norfolk R. R., operated in connection with the Pennsylvania R. R., is about to make New Southern connections. The company has purchased the North Carolina Central R. R., and by building short stretches of road an all-rail connection can be made between Weldon and Wilmington, one of the termini of the North Carolina Central R. R.

The Jacksonville, Tampa & Key West R. R., which has very recently been opened to travel through its entire length, is an enterprise in which a considerable amount of Connecticut capital is enlisted. Its main line, from Jacksonville to Sanford on Lake Monroe, is 125 miles long, and passes through Palatka, De Land and other places. At Sanford it connects directly with the road which runs from there to Tampa on the west coast.

Long Island R. R.—The people of Riverhead have sent a petition to Austin Corbin asking him to abandon the branch railroad between Manor and Eastport and build a new line from Riverhead to Quogue to connect with the Montauk Division. Mr. Corbin is also requested to extend the Port Jefferson line to Riverhead. Vice President Maxwell thinks that if the Riverheaders would provide the right of way and do the grading Mr. Corbin might accede to their wishes.

The New York, New Haven and Hartford R. R. is actively pushing work in the direction of giving greater traveling facilities to people along its line, and of discouraging parallel projects. The laying of four tracks from the Harlem river to Stamford is still in progress and will be continued right along until Hartford is reached. As the extra tracks are laid it is proposed to furnish a section of Connecticut through which the above new road proposes to pass with a larger number of way trains than at present.

The Philadelphia, Newton Square and Chester R. R. Co. has been incorporated, with a capital stock of $2,500,000. The President is James B. Washington, of Allegheny City, and all but one of the Directors are from Pittsburg. The line will be twenty-five miles long, one terminus being at West Chester, and the other at a point on the Philadelphia and Baltimore R. R. where the latter crosses Cobb's creek, in Delaware county.

The Brooklyn Rapid Transit Commission has decided on the routes for the line. Atlantic avenue was fixed on as the proper line, the road to run along that thoroughfare from South ferry to East New York. The power of the Commission terminates at the city line, but the builders of the road will undoubtedly obtain authority to extend it further east. The road is divided into four sections, three on Atlantic avenue and the fourth comprising a short branch running from Atlantic avenue to Fulton street, through Boerum place, to connect with the trunk line for Fulton ferry.

The Terminal Underground R. R. Company, articles of incorporation for which have been filed in Albany, has been organized with C. V. Sidell as President and Ogden D. Pell as Treasurer. With its capital of $5,000,000 it proposes to carry out the old Vanderbilt improvement scheme of a tunnel from the City Hall up to the Grand Central Depot, from which tunnel branches will be run to various ferries on both east and west sides of town. The rights and privileges of the two companies which had contemplated a similar plan have been acquired by purchase, and conflicting interests reconciled by a consolidation in this scheme.

New York and Boston.—The project of a direct line of easy grades between New York and Boston, which shall reduce the running time to about four hours, has been recently revived with apparently stronger backing than heretofore. The scheme contemplates a road with no grades greater than one per cent. or curves of more than two degrees, to have no grade crossings and but two drawbridges. To facilitate the building of such a road, a construction company with $750,000 capital, called the New York and Boston Rapid Transit Company, has been organized under the laws of New Jersey. This corporation has the franchises and interests of the New York and Boston Inland, of Massachusetts; the New York and Boston, and the New York and Connecticut Air Line, both of Connecticut, and the New York, Connecticut and Eastern, of New York. The necessary extension of time under some of these charters has been obtained. The Rapid Transit Company, which includes among its directors some prominent Eastern capitalists, proposes to build the 183 miles of road for $25,000,000 of five per cent. 20-year bonds and $25,000,000 of stock.

Public Works Financing in France.—In 1879, the Chambers adopted M. de Freycinet's extensive programme of public works to be executed throughout the country, the amount named and sanctioned being $900,000,000. Three years later the same Minister, who is now Premier, was obliged to acknowledge that he had made a slight mistake in preparing the estimates, and that the sum required to complete the works commenced amounted to $1,800,000,000, just double the amount originally named.

The Department of State Railways, which controls 1,550 miles of road, has already cost the government a sum of $165,000,000, and when completed, will represent a capital of $186,200,000. The excess of the annual receipts over the ordinary working expenses of the lines already opened is only $600,000, whereas an annual sum of $8,200,000 is required for the interest and amortization of the capital invested alone.

What would be thought of a guardian who had sunk $190,000 of his ward's capital in the purchase of an annuity of $400?

New Bridges on the Wabash R. R.—Master E. T. Allen has reported on the petition of the receivers of the Wabash R. R. for advice with regard to bridges which are in need of repair. The master finds from testimony taken by him that the bridge on the main line at Wildcat creek, Tippecanoe county, Ind., was constructed for much lighter rolling stock, and the bridge is in an unsafe condition. To put it in good condition would require an expenditure of $28,000. The same facts are true regarding the bridge over Mauvisterre creek in Morgan county, Ill., on the line between Quincy and Toledo. An expenditure of $4,500 is needed there. The master says: "Inasmuch as it appears from the evidence before me that the passenger trains operated by the receivers over those bridges by means of locomotives largely exceeding in weight those for the carrying of which the bridges were originally designed and run at a high rate of speed, there is in my opinion, danger of great loss of life and property unless prompt measures are taken to replace these bridges, now worn out, with stronger structures. I recommend that the receivers be ordered to reconstruct the bridges, and until they can be rebuilt to use every precaution to make the present bridges safe."

The Hillsborough & Manatee R. R. Co. has been incorporated in Florida by I. B. Stone, John P. Hill and Victor D. Ransome.

The Utica & Black River R. R. Co. will consolidate with the Ogdensburg & Morristown and the Clayton & Theresa railroads.

Railroad to Alaska.—A bill has been introduced providing for the exploration and survey of a railroad from the northern boundary of the United States through British Columbia to a harbor on the Alaskan peninsula.

Wyoming Eastern R. R.—Surveys are being made from Independence Rock on the Sweetwater to a connection with the Wyoming & Utah and Ogden Short Line railroads, eighteen miles west of Granger; and east from Independence Rock to Fort Fetterman.

Colorado Midland R. R.—The line is to be built from Leadville to Aspen; work to be completed by January 1, 1887. The road is intended to be extended from Colorado to the Pacific Coast, and has been surveyed from the eastern terminus to the Utah line.

The Kansas and Southwestern R. R. has been incorporated to build from Concordia to the south state line. Directors, C. J. Jones, A. H. Burtis and Charles F. M. Niles of Garden City; Frank Hopkins, Walker, Ellis County, and Henry O'Shant, Hays City. Capital stock $2,000,000.

Spokane Falls & Palouse R. R.—A company has been organized at Spokane Falls, Wash. T., to build a line of forty-six miles from Marshall, on the Northern Pacific R. R. into the wheat region. The company will use the Northern Pacific line from Spokane Falls to Marshall, a distance of nine miles. Work will be commenced this spring.

The Oregon and Washington Territory R. R. has been incorporated to build a road from Wallula, W. T., to Pendleton, Ore. Capital stock, $200,000. Headquarters at Pendleton. The incorporators are Jacob Frazer, W. S. Byers, H. L. Marston, W. W. Cavness, H. W. Wheeler, W. T. Chalk, R. Alexander and John J. Balleray.

The Kansas City, Independence and Park R. R. Co. has been organized for the purpose of constructing a narrow gauge railway from Independence to Kansas City, a distance of ten miles. The incorporators are Joseph S. Chick, John W. Byer, James M. Love, Albert M. Winner, and Willard E. Winner, of Kansas City; Henry E. Marshall, of Independence, and James E. Harper, of Westport.

Another Mississippi Bridge.—The Wisconsin, Illinois, and Iowa Bridge Company has been organized at Dubuque, Iowa, to build a bridge over the Mississippi at Eagle Point. The incorporators are A. F. Touzalin, President of the Chicago, Burlington and Northern R. R.; George B. Harris, General Manager of the same road; J. J. Linehan, State representative; William S. Molo and B. E. Linehan, of Dubuque.

Pennsylvania R. R. Branches.—The survey is being made for the proposed branch from Shickshinny to Milton, Northumberland county. It will be fifty-six miles long, and will connect with the North and West branches of the P. R. R. at Mocanaqua. The company has also under consideration the project of building a branch line between Landingville and Orwigsburg, a distance of three miles, to connect with the Schuylkill Valley branch at Landingville.

The St. Louis Transfer Co. is maturing plans for an elevated railway to connect the levee tracks with the various railway depots in the city, thus bringing all the roads within a single system. The line of double track will be 2¼ miles, and the total cost $450,000. By this plan, buildings along the river front can be transformed into commercial houses, having rail facilities on one side and a level street for drayage upon the other, at the same time leaving the wharf free from obstructions. New York needs such a road on West and South streets.

American Continental Vertebra R. R.—Mr. Curtin, of Pennsylvania, recently introduced a bill in the House which must be considered the most remarkable one of the session. The plan is to construct a railroad which will begin at some point on our southern boundary and run thence through Mexico, Central America and Columbia, there branching out to the east, and west so as to include Venezuela, Peru, Ecuador, Brazil, Bolivia, Paraguay and Uruguay, so that the Pacific terminus shall be at Valparaiso and the Atlantic terminus at Buenos Ayres.

The Hutchinson, Greensburg & New Mexico Railroad has been chartered in Kansas to run from Hutchinson, Kan., to Albuquerque, N. M., with a branch line from the main line in the "neutral strip" in the Indian Territory to Trinidad, Col. The total length of the road is 550 miles. The directors are E. L. Meyer, S. W. Campbell and Hiram Raff, of Hutchinson; C. W. Myers, S. B. Sproule and E. F. Greensburg, Kansas, and George W. Melville, of Durango, Col. The capital stock is $5,000,000.

The Cascade Tunnel.—The big tunnel on the Cascade branch of the Northern Pacific R. R. will be the largest in America except the Hoosac. It will be 9,850 feet long, bored thorugh solid rock. The summit of the mountain is 1,150 feet above the tunnel, so that there has been no possible chance to make an air shaft, and the work is prosecuted from both ends. The tunnel will enable the Northern Pacific R. R. to cross the same range of mountains at an elevation of 2,850 feet that the Central Pacific R. R. crosses at an elevation of 7,300 feet.

A Michigan Ship Canal.—A few days ago an old chap from northern Michigan came east for the purpose of organizing a company to dig a ship canal from the head of Saginaw bay to Pentwater, straight across the state of Michigan. When asked how his project got along he replied:

"I'm going home. You eastern folks are no good any more. That 'ere canal should be dug for $27,000,000. I'd agree to act as president of the company for $5,000 a year. We could raise $150,000 worth of celery along the banks every season. I've got five sons who'd act as bosses for $3,000 apiece a year. We could cut $50,000 worth of ice every winter, and we could raise $75,000 worth of geese and ducks every summer. But nobody'll take hold. Don't seem to be any backbone down this way."—*Wall Street News.*

East Tennessee, Virginia and Georgia R. R.—KNOXVILLE, TENN., March 18th.—Judge John Baxter of the United States Circuit Court, to-day ordered the sale of this railroad, on the application of the Central Trust Company of New York; the sale to occur after six weeks' advertising, and not later than the 25th of May. Payment to be $100,000 on the day of sale, and the balance either in cash or in mortgage bonds. No bid will be taken for less than $10,000,000. The total indebtedness is about $16,000,000. The sale will include all the lines from Knoxville to Brunswick, Bristol and Meridian, with the branches and other property, including certain stock in the Knoxville & Ohio R. R., and Memphis & Charleston R. R. The purchaser will take the road, subject to all prior valid liens, which amount to about $7,500,000. This takes the road out of the hands of the receiver as soon as the sale is confirmed. It is generally understood that the present bondholders, who recently proposed a reorganization scheme, will be the purchasers.

To Remove the Rio Grande Bar.—The report of the eminent Dutch engineer Peter Caland, who was recently employed by the Government to examine and report upon the Rio Grande bar, has been presented and published. He fully agrees with the Bicalho commission as to the causes operating to produce and maintain the bar, which are the winds and currents from the outside, and also as to the general measures to be employed to improve and maintain a navigable channel. The assertion of a daily colleague that the Bicalho commission was the first to make scientific observations upon the causes producing the bar is erroneous, for such observations were made years before by an English engineer located in Rio Grande, who not only demonstrated the fact that the bars were formed by the outside currents and waves, but prepared plans and estimates for a breakwater to counteract their influence. Mr. Caland concludes that the only effective scheme for opening and maintaining a channel is the construction of two long piers, the westerly one 4,960 metres and the easterly 3,350 metres in extension and then to open and maintain the channel with dredges. The total cost of the two piers is estimated at $14,700,000 (presumably gold) and that of dredging at $4,800,000, a total cost of $19,500,000. The time fixed for the execution of the works is 10 years.—Rio de Janeiro *News.*

Cape Breton Railway Surveys.—H. F. Donkin, engineer in charge of the survey of Cape Breton railways, states that operations were commenced about the middle of August at Port Hawkesbury, on the Cape Breton side of the straits of Canso, whence an instrumental survey was made to Louisburg. This is known as the southern route, and the country though which it passes is unsuited to agriculture, but abounds in minerals, including copper, iron, jet, gold, etc. There is little or no timber of the class required in railway construction. From Louisburg Mr. Donkin's party went to Sydney, and surveyed the central route from that point back to Hawkesbury via the Grand Narrows, a total distance of 170 miles, or about 85 miles for each line. The central route passes through a good farming country, well supplied with timber. A preliminary survey was also made via the south shore of the Bras d'Or lakes to North Sydney, the distance being somewhat shorter than to Sydney, the country being equally fertile, and presenting fewer engineering difficulties. The railway through the Island of Cape Breton, when completed will give the International R. R., an ocean outlet, via the Government line known as the Eastern Extension, and will open up one of the best coal and other mineral districts in Canada. The surveys were finished about the end of February, and the plans and profiles are now being prepared, in the department at Montreal.

Miscellaneous.

Fastest Steamer in the World.—The new torpedo boat built for the English Government by Yarrow & Co. has attained the wonderful speed of 24.027 knots, or 27.66 miles, an hour. This beats the record of the Stiletto, and makes the English craft the fastest steam vessel in the world.

Soundings in the South Pacific.—A line of soundings just completed across the South Pacific from New Zealand to the Straits of Magellan, by Commander Barker, U. S. N., found 3,002 fathoms, near Chatham island, the greatest depth.

Steel Girders.—Experiments on an extensive scale have been made in Germany to ascertain the relative strength of iron and steel girders. The soft-steel girders proved to be 22 per cent. and hard-steel girders 66 per cent. stronger than the iron girders; and it is remarked that it seemed pretty well established that the strength of steel girders is about the same for the two flanges, if made alike in section.

Pittsburg Coal Fields.—The amount of coal in the Pittsburg regions is estimated by Prof. Lesley of the Pennsylvania Geological Survey at 30,000,000,000 tons. About 11,000,000 tons are now taken annually from this bed, of which two-thirds are bituminous coal, and one-third anthracite. Prof. Lesley believes that the oil and gas supply will practically cease ten or twenty years hence.

Rainfall in New England.—The great rainfall in New England in February is declared by meteorologists who have studied it to have been unprecedented since records began to be kept. The total amount of water which fell, chiefly during twenty-four hours, is computed to have amounted to 750,000,000,000 gallons. The fall was greatest between New London and Providence

Tire Soaking-Pits.—The Osnabruck Steel Works have introduced the use of soaking-pits for steel tires, with excellent results. Immediately after they have been rolled they are carried by means of an overhead track to the pits, round holes lined with refractory brick, which are capable of holding twelve tires. As soon as filled a lid is put on the pit, and the tires are allowed to cool, which usually takes three to four days. It is claimed that drop tests show an increase in strength of 50 per cent. over the tires which are allowed to cool in the open air, or in ashes.

Long Distance Telephoning.—A very successful test of a new telephone, the invention of G. C. Turnbull, of Baltimore, was made recently over a wire extending from Washington to New York, a distance of 240 miles. Conversation was carried on throughout the day without difficulty, and with results showing that the human voice could be transmitted over this long distance louder and more distinctly than it ordinarily is over the short city circuits of other telephones. Mr. Turnbull claims for his invention an improved method of making the carbon contact in the telephone transmitter, as well as an improvement in the apparatus for collecting the sound waves at the receiving end of the line.

Glass Flooring.—The substitution of glass flooring for boards continues to increase in Paris, this being especially the case in those business structures in which the cellars are used as offices. At the bank of the Credit Lyonnais, the whole of the ground in front is paved with large squares of roughened glass embedded in a strong iron frame, and in the cellars beneath there is sufficient light, even on dull days, to enable clerks to work without gas. The large central hall at the offices of the Comptoir d'Escompte has also been provided with this kind of flooring; and although its prime cost is considerably greater than that of boards, glass is in the long run far cheaper, owing to its almost unlimited durability.

The Hyalolyphotype.—By means of the new and ingenious little instrument known as the hyalolyphotype, or hot pen, drawings can be made on glass or glassy substances with a waxy composition, which is solid and somewhat hard at ordinary temperatures. The pen is so contrived that it can be heated either by gas or by an electric current, and the waxy materia flows easily from the heated pen, setting so quickly on the glass that cross-hatching can be done more rapidly than with ordinary pen and ink, without risk of blocking up the angles; corrections, too, can be made with the greatest ease by means of a penknife, which leaves the surface afterward intact. After the drawing has been made, the plate is etched by fluoric acid, and when complete it can be either electrotyped, stereotyped, used direct, or applied to any purpose for which engraved surfaces are required.

Market Report of Engineering Materials.

New York April 1, 1886.

NOTE.—The following Market Report gives wholesale prices on the New York Market unless otherwise stated. It is intended as a general guide to the estimating engineer. We give it with this caution, that, as is well understood in business transactions, the amount of bill, distance from market centre and conditions of payment will have a material influence on the final paying prices.

IRON.

STRUCTURAL IRON.		
Angles	2.00c	@ 2.10c
" steel	2.35	@ 2.45
Tees	2.35	@ 2.40
Beams and channels, American	3.0	@
Tank Plates	2.15	@ 2.20
Shell Plates	2.4	@ 2.5
Steel plates, Tank	2.5	
WROUGHT-IRON PIPE. PITTSBURG.		
Butt welded, black.....Discount	42½	@ 45
" " galvanized..... "	32½	@ 35
Lap welded black..... "	60	@ 62½
" galvanized..... "	42½	@ 45
Boiler tubes..... "	55	
RAILS.		
Steel (large lots at mill)	$34.50	@ $35.00
Old rails	20.00	@ 21.00
Old rails, steel	22.00	@ 23.00
R R. spikes	2.40c.	
R R. splice-plates	2.00	
R R. track bolts, square nuts	3.00	
Barb-wire fencing, galvanized		5.00
" painted		4.00
Corrugated iron		
Nails		
Iron, per keg	2.40	@ 2.45
Steel do.	2.60	@ 2.70

METALS.

COPPER.		
Lake Superior	$11.40	@ 11.50
Other Brands	10.00	@ 10.25
LEAD.		
Com. Domestic	4.90	
Lead Pipe	.06¼c.	
Tin-Lined Lead Pipe	.15	
Sheet Lead	.07¼	
ZINC.		
Sheet	$5.40	@ 5.60

BRICK.

Cargoes (afloat)		
Haverstraw.....per M.	7.25	@ 7.75
Fishkill		
Up-River	7.00	@ 7.50
Jerseys	7.00	@ 7.50
Long Island	8.00	@ 8.50
Pale	4.00	@ 4.50
FRONTS.		
Croton, red	12.00	@ 15.00
" dark	12.00	@ 15.00
" brown	11.00	@ 14.00
Philadelphia pressed	24.00	@ 25.00
Trenton "	24.00	@ 25.00
Baltimore "	37.00	@ 41.00
Buff "	33.00	@ 35.00
Enameled English	65.00	@ 130.00
" American	85.00	@ 120.00
Fire brick	24.50	@ 55.00

CEMENT.

The following price current is made up entirely from quotations furnished us directly by the firms dealing in each brand; the prices are understood to be wholesale in New York, subject to such special rates as large quantities may warrant:

Alsen's Portland Cement Works	$2.50	@ $3.00
BAETJER & MEYERSTEIN:		
Hanover Portland	2.60	@ 2.65
BELLONI & Co.:		
Hemmoor "Crown" brand		2.50
JAMES BRAND:		
K. B. & S	2.55	@ 3.00
BROOKS, SHOOBRIDGE & Co.	2.45	@ 2.60
HOWARD FLEMING:		
Gibbs' English Portland, 400 lbs	2.65	@ 2.90
K. B. & S. " "	2.75	@ 2.95
Stettiner, German	2.65	@ 2.85
Lagerdorfer, "	2.45	@ 2.75
Fleve, A 1, Belgian	2.35	@ 2.50
Roman	2.75	@ 3.00
Keene's Coarse	4.75	@ 5.50
" Fine	7.75	@ 8.50
" Superfine	8.50	@ 10.00
FISHER, ERSKINE W.:		
Stettin (German) Portland Cement	$2.40	@ 2.75
GABRIEL & SCHALL:		
Vorwohler "Lion"	2.65	@ 3.10
HUDSON RIVER CEMENT Co. Rosendale		1. 0
JOHNSON & WILSON:		
Saylor's American Portland	2.15	@ 2.40
LESLEY & TRINKLE, Philadelphia, Pa.:		
"Giant" Portland	2.20	@ 2.40
Improved "Union"	1.25	@ 1.50
Union	1.10	@ 1.20
MARCIAL & Co.:		
J. B. White & Bros. Coarse	4.50	@ 5.00
" Fine	8.00	@ 10.00
" Portland	2.45	@ 2.85
NEW YORK CEMENT Co.:		
Rosendale		1.20
N. Y. & ROSENDALE CEMENT Co.:		
Rosendale, "Bridge" brand		1.10
SINCLAIR & BAUSON:		
K. B. & S	2.35	@ 2.60
STANDARD CEMENT Co		
E. THIELE:		
Dyckerhoff	2.90	@ 3.25
UNITED STATES CEMENT Co.:		
Windsor	1.00	@ 1.10
Standard		1.15
Coxe's Portland	2.15	@ 2.40
UNION AKRON CEMENT Co.:		
Akron "Star" brand.		

ASPHALT.

ROCK.		
Prices range per ton	$15.00	@ 20.00
According to quantity or brand, and whether taken from vessel or store.		
PAVEMENT.		
Barber's Asphalt	$2.50	@ $3.50

LIME.

Rockland, common per bbl	1.00	
" finishing	1.20	
State, common	.90	
" finishing	1.10	
Kingston, ground	.95	@ 1.00
Add 25c. to above figures for yard rates.		

STONE.

Cargo rates at New York.

Amherst freestone, No. 1 per cub. ft.	0.95	@ 1.00
" " No. 2 "	0.75	@ 0.85
" " light drab "	0.80	@ 0.95
Berlin " in rough "	0.75	@ 1.00
Berea " "		
Brown stone, Portland, Ct. "	1.00	@ 1.35
" Belleville, N. J. "	1.00	@ 1.35
Granite, rough	0.45	@ 1.25
Common building stone per load	2.00	@ 3.00
Base stone, from 2¼ to 6 ft. lengths, per lin. ft.	0.40	@ 3.00

SLATE.

Purple roofing per square	6.00	@ 7.00
Green "	6.00	@ 7.00
Red "	15.00	
Black Penna. (at New York) "	4.50	@ 5.00

LUMBER.

Prices for yard delivery in New York.

PINE, Common box per M.	18.00	@ 20.00
" Choice "	65.00	@ 70.00
Tally plank, 1¼ in. 10 in. dres'd. each.	.44	@ .50
Tally boards, dressed com. "	.28	@ .30
SPRUCE, Boards dressed "	.25	@ .28
Plank, 1¼ in "	.28	@ .30
" 2 in. "	.38	@ .40
" 2 in. dressed "	.43	@ .45
Timber per M.	20.00	@ 22.00
HEMLOCK, Boards each.	.18	@ .20
Joist, 2¼ × 4 to 4 × 6 in	.16	@ .44
OAK per M.	55.00	@ 65.00
CYPRESS 1, 1¼, 2 and 2¼ in "	35.00	@ 40.00
YELLOW PINE, Girders "	25.00	@ 30.00
Dressed flooring "	28.00	@ 35.00
SHINGLES, Extra shaved pine, 16in. "		
" sawed 18 in. "	5.75	@ 6.00
LATH, Cargo rate "	2.15	@ 2.25

PAINT.

Lead, white, American dry per lb	.04¾	@ .06
" " in oil pure "	.06¾	
" English, B. B. in oil "	.08¾	@ .08¾
" Red, American "	.05¾	@ .05½
Litharge "	.05	@ 05½
Venetian red, American "	.01	@ .01¼
Indian red "	.05	@ .10
Vermillion, American lead "	.10½	@ .12½
Paris green "	.15	@ .20
Umber, Amer. raw and powdered per lb.	.01¾	@ .01¾
Drop black, Amer. "	.07	@ .13
" " Eng. "	.11	@ .13
Chrome green "	.05	@ 20
Oxide zinc, American "	.03¾	@ .04
" French "	.06	@ .08

Trade Notes.

A MILL in which wide flat bars are formed from old rails has been patented by E. D. Wassell, of Pittsburg, Pa.

FIVE moguls for the Western Division of the N. Y. L. E. & W. R. R. are being built at the Susquehanna shops.

THE Pittsburg Bridge Co., has booked orders to employ the works for some time; one is for an iron swing at Chicago.

THE New Albany, Ky., Rail-Mill is running on contracts for fishbars and spikes for the C. O. and S. W. R. R.

JAMES GOODMAN & Co. will erect an iron foundry at Pittsburg, Pa.

THE renewal of one-fourth of the iron track of American railways which are more than ten years old will require something like 615,000 tons of rails per year.

C. B. BEACH, of Cleveland, O., has patented an apparatus for converting worn or defective railroad wheel tires into bars or billets for various uses.

THE N. Y. Central & Hudson River R. R., has contracted for fifty new passenger cars to be built at Dayton, O., Wilmington, Del., and Troy, N. Y.

FIRES have been again lighted at the Junction Iron Company's steel-plant at Mingo, O., and 150 men given employment. The plant had been shut down for repairs.

THE Missouri Malleable Iron Co. is fairly burdened with orders for both the malleable and grey iron departments. The contemplated addition to the foundry will be 70 x 200 feet.

THE Bigelow Blue-Stone Company at Malden, N. Y., is shipping large quantities of manufactured stones for the construction of the Brooklyn Elevated R. R.

ANOTHER order for 500 cars for the Chesapeake and Ohio R. R. has been received by the Ensign works. This makes a total of 722 cars now ordered there. They have also orders for 7,000 to 8,000 car wheels.

THE Union Iron Works has received a contract for building for the Pacific Mail Company a steel steamship 190 feet long and 24 feet beam. She is designed to run between San Francisco and Panama.

THE anthracite coal companies have mined and delivered 1,500,000 tons of coal more this year than last to date.

THE Hydro-Electric Railway Motor Company, at Chicago; capital stock, $500,000; incorporators, Charles Wondries, Jr., Henry W. Plum and George Brauns, Jr.

THE Westinghouse Air-Brake Company has received the contract for furnishing air-brakes for several hundred freight cars for the Atchison, Topeka & Santa Fe R. R., to be finished as rapidly as possible.

HEAVY contracts for lumber are being placed, lest the threatened active demand should produce an advance in prices. Several million feet of white pine have already been contracted for, for Boston, New York, and Philadelphia.

PAVING.—Mr. A. L. Barber, of the Barber Asphalt Paving Co., has patented a pavement consisting of a hydraulic concrete foundation with an asphalt concrete wearing surface. The curbstones and street rails are embedded in the concrete.

SUGGESTIONS FROM SHIPBUILDERS.—The Board on Additional Naval Vessels has issued a circular letter to shipbuilders in regard to the construction of the four vessels provided for by the act of March 3, 1885, which is accompanied by a copy of a report describing the general features and requirements of the vessels.

A NUMBER of Pittsburg capitalists have formed a company for the erection of steel-works at Germantown, where the company has purchased fifty acres of land, on the Pittsburg, Virginia & Charleston R. R. The plant will have two five-ton Bessemer converters of the most modern pattern.

THE Pencoyd Iron Works, Philadelphia, (A. & P. Roberts & Co.) have been closed on account of a strike of the employes for an increase in wages. The company stated that it is impossible to bid on work in the present unsettled state of affairs, and that having no large orders on hand, they would close the works.

THE Pottstown, (Pa.) Iron Company has posted notices announcing an increase of 25 cents per ton for puddling, from $3 to $3.25, while the wages of the heaters, rollers, nailers, feeders, machinists, and blacksmiths will be increased 5 per cent., and the wages of the laborers 10 cents per day, from 90 cents to $1.

AT Coeyman's, N. Y., a brick yard is to be established by Sutton and Suderly of Glasco, Ulster county. It will have a capacity for 1,000,000 bricks a day. Sutton & Suderly will spend from $6,000 to $8,000 for improvements and necessary machinery, and will commence at once. They will employ about 100 men.

AT Krupp's Works a railroad truck has just been built with sixteen axles. It was made for the special purpose of transporting by rail a cannon, which is 50 feet long and weighs nearly 136 tons, from Essen to Spezzia, in Italy by way of the St. Gothard tunnel. The truck is 76 feet long, and the axles are divided into groups of four, which easily adapt themselves to the curves in the road.

THE Carnegies have begun work on an order of 8,000 tons of steel rails for the extension of the Chicago, Milwaukee & St. Paul R. R.; 2,500 tons are to be shipped in April, the same amount in May, and 3,000 tons in June. The same firm has just finished an order of 150 tons of mine rails. They will be shipped to El Paso, from whence they will be taken to Mexico where they are to be used in some of the silver mines.

THE car-builders who went from Jeffersonville to Pullman, Ill. under the inducement of good wages, say that the Pullman Car Company pays $10 for carpenter work in building a freight car, and as it takes four men two days to build a car it only amounts to $1 25 per day for each man. The Jeffersonville men will soon return home.

EXTENSIVE marble quarries have been discovered in Inyo county, Cal. The quality varies from common building material to the finest statuary marble. At present the Vermont quarries furnish the most available supply of marble for full-sized statues. The Italian quarries have been so exhaustively worked that large blocks of pure quality are obtained with difficulty.

STERLING & WIEBNER, proprietors of the West Reading Boiler Works, Reading, Pa., have received the contract to raise the Topton Furnace stack 15 feet higher. The iron stack is 26 feet in diameter. They are also furnishing a new 60 horse-power boiler and new iron stack for E. S. Fox & Co's terra cotta and fire-brick works, Reading.

THE old Omaha Iron Works, Omaha, Neb., have been reorganized and will hereafter be known as the Paxton & Vierling Iron Works. The proprietors will at once enlarge the facilities for manufacturing all kinds of architectural ironwork. The manufacture of steam engines will be a specialty. Aside from this they will manufacture boilers, hoisting and mining machinery, hand, steam and grain elevators, etc.

THE Tanner & Delaney Engine Co., Richmond, Va., has shipped a locomotive to the Cincinnati and Newport Iron and Pipe Co. It has four coupled wheels, without truck; cylinders, 7 x 16; wheel base, 4 feet. It will easily take a curve of 20 feet radius. The company is turning out a number of small locomotives to run on wooden and iron railways, and also locomotives for pole railways.

THE Atlanta, Ga., Bridge & Iron Works, a new corporation formed by Wilkins, Post & Co., offer that property for lease. It includes 6¾ acres of ground, machine shop, foundry, power hammer, and a full outfit of tools and machinery; railroad track running through center of property. Car building can be added, also a small bar mill, a portion of which is on the grounds in process of construction. Maj. W. R. Tuttle, of Knoxville, Tenn., is the President of the new company, and Mr. J. C. Kirkpatrick, of Atlanta, Secretary and Treasurer.

NEAR St. John's Run, on the B. & O. R. R., there is a sand works run and owned by Pittsburg parties, the sand from which is used for the manufacture of glass. The sand stone is got out of the mountain by tunneling into a solid bed of that formation, and conveyed by a tramway to the mill, situated near the railroad, where it is ground and prepared for use. It is white, having the appearance of granulated sugar. The proportion of silica in this sand is greater than in any known in the United States, and the supply is claimed to be inexhaustible. The capacity of the mill is from forty to fifty tons a day.